

# **A COMPUTERIZED CORPORATE PLANNING MODEL OF A WOOLLEN TEXTILE COMPANY**

A Thesis Submitted  
in Partial Fulfilment of the Requirements  
for the Degree of  
**MASTER OF TECHNOLOGY**

by  
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*to the*  
**INDUSTRIAL & MANAGEMENT ENGINEERING PROGRAMME**  
**INDIAN INSTITUTE OF TECHNOLOGY, KANPUR**  
**MAY, 1983**

To

My Beloved Parents

1981

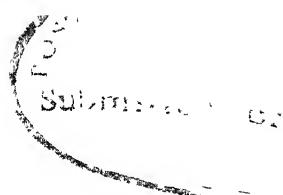
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## CERTIFICATE

This is to certify that the present work on  
'A Computerised Corporate Planning Model of a Woollen  
Textile Company', by Naresh Kumar has been carried out  
under my supervision and has not been submitted elsewhere  
for the award of a degree.



May, 1983

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I had started thinking about the dynamic behavior of the firm and its broad perspectives in the beginning of the September 1982. I made an approach to the company in the month of January 1983 for my continuous involvement to study the company's systems and problems of managerial relevance. During the visit to the company, I had collected the required informations for analysis. Since then I have been working to this problem.

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## ABSTRACT

This thesis designs a Computer Based Corporate Planning Model for a Woollen Textile Company in Northern India. The planning model integrates all the three basic activities of the firm viz. Marketing, Production and Financial. It contains an array of empirical relationships based on past data. These relationships and a set of accounting identities predict the effect of changes in environment and Co.-policy on company's performance. This serves as a tool for the top management of the company for rapidly evaluating alternative policies, thus leading to better decisions. All the major influencing factors have been considered in developing the complete planning model. Some sample results and future scenarios have been attached along with computer program. Also this study can be useful after minor modification to any Woollen Textile Company working under similar set of conditions and market environment.

## CHAPTER I

### INTRODUCTION

#### 1.1 Scope of Corporate Planning Models in Management:

For continued corporate survival and growth in a competitive and rapidly changing economy:

- A Company must maintain a keen awareness of its own resources and capabilities, and remain alert to changes in its own markets as well as those of other firms.
- Management have timely and accurate information with which to assess the potential value of an opportunity.
- Corporate performance must be maintained at a level which provides investment capital for ventures having acceptable labels of risk and uncertainty.

In order to meet these requirements, a company must develop and adhere to a corporate plan which provides directions for the future.

In planning, policies and objectives, programme of production and method of production etc. are decided before hand. Planning at the top level for a business organisation or activity is extremely important and subsequent lower level planning and actions will follow.

### 1.2 Computer Based Planning Models:

A large number of firms in the western countries are either using, developing, or experimenting with some form of corporate planning model. Computer-based planning models represent an attempt to describe the complex inter-relationships among a corporation's financial, marketing and production activities in terms of a system of mathematical and logical relationships which have been programmed into a computer [13]. The essence of corporate planning is to help top management make decisions in the face of risk and uncertainty. We hardly see any business having no risk, no uncertainty, no external forces and no competitors. Every company's management would like to know the answers to some difficult questions like what would be the company's market share if certain pricing policy is followed. Through a corporate planning model, alternative scenarios can be generated reflecting a wide variety of different managerial policies for internal operation and assumptions about external environment in which the firm operates.

Each firm has its own objectives and it operates on its own way in the market. Its actions will get affected by certain uncontrollable factors for example:

- i) Political and legal environment
- ii) Economic Environment
- iii) Cultural and Social Environment
- iv) Existing Business Situation and Competitions

These diverse and uncertain external factors force the decision makers to formulate models which may be able to predict the future results of present actions. The top management has become increasingly aware that the old ways of muddling through ~~are~~ are not adequate to meet the present as well as future challenge of the business in turbulent market conditions. This is the major reason why corporate managers have <sup>been</sup> inclined to computer based planning models during recent times. These help them get quick answers to important questions which arise due to series of constraints and opportunities generated by the environment. These planning models can be a powerful tool for the decision maker and policy maker of the company to take various decisions, to evaluate alternative courses of action, and to achieve an improved future of the company.

According to the survey conducted by Gershefski<sup>on</sup> the usage and importance of corporate planning models, the models can be used .

- a) to determine feasible corporate goals
- b) to evaluate alternative policy
- c) for long-term and short-term planning
- d) for financial forecast
- e) for sales forecasts
- f) for investment analysis
- g) for budgeting
- h) for profit planning and various other aspects of the managements decisions. The survey report [22] says

that:

- i) 95 percent of corporate models are computer-based and they are of simulation type.
- ii) 88 percent of the models are of deterministic in nature.

Thus, the models are interactive and systematic representation of complex business system of the company and primarily used for the purpose of forecasting, budgeting, and controlling the financial performance of the company. The major benefits which present users of the planning models have derived include: [13]

- a) ability to explore more alternatives
- b) better quality decision making
- c) more effective planning
- d) better understanding of the business and
- e) quick responsiveness

Therefore corporate planning models generally produce a set of objectives designed to address the most significant long-range needs of the company, allocates available resources among the objectives on the basis of relative priorities, and provide guidelines to be followed by the operational planning.

## CHAPTER II

### METHODOLOGIES FOR CORPORATE PLANNING MODELS

T.H. Naylor has discussed several methodologies for corporate planning models and has explored some practical difficulties involved in implementing each of the methodology. The following methodologies are very common for planning process [14].

1. Optimization Approach
2. Systems Approach
3. System Dynamic Approach
4. Econometric Analysis

#### 2.1 Brief Descriptions of Alternative Methodologies:

##### 1. Optimization Approach:

This approach proceeds with a specific objective function subjected to number of constraints, and will be desirable where Corporate goal is to minimize cost function or to maximize profit function. The above objective is true but might not be sufficient for any company. Most companies have multiple objective which may not be fixed for long run. For example for couple of periods it may think of maximizing productivity, and next to maximize sales revenue, next to maximize market share and so on. Therefore, a planning model based on optimization

seems to be futile. As an analyst it is very difficult to get the decision maker's preference for the corporate goal. Moreover the constraints are situational and their values are not fixed. This optimization approach also needs perfect knowledge about the nature of cost function, production function, revenue function and so and so forth which is hardly elicited from a complex system. Bonini Charles (1963) argues that one cannot examine the behavior of the firm considering optimization approach. It is very restrictive and can give only one particular behavior. Therefore, this approach is not suitable for our case where we want to see the overall behaviour of the company.

## 2. Systems Approach (or Target Variable Approach):

It says that the behaviour of the firm can be described by a set of equations in which it assumes that decision maker has specified a target value for each of the endogenous variables and the equations are solved simultaneously for given values of the exogenous, lagged endogenous and stochastic variables. The problem of balancing the number of equations and the number of decision variables is likely to be a serious limitation of this approach [14]. Setting up a specific target for particular variables is also questionable. Availability of this information to the analyst is an impossibility. This approach is not flexible. For example, in the model one has included all the variables which are of considerable important to

the decision maker. Suppose, after some time, one wants to insert or delete few decision variables which is quite natural in the business system. This leads to serious problem of balance.

### 3. System Dynamics Approach [5]:

This is method of analysing problems in which time is an important factor. The main aim is to find policies which will control the firm effectively in the face of the stocks which will fall upon it from the outside world. Generally system dynamics approach is good for study of the dynamic behavior of the firm which suggest changes to structure, policies or both, for improvement in the behavior. To set up a dynamic model for simulating company behaviour one must adequately describe the real system which it represents. Getting the data will often be difficult. If the company under study produces seasonal items where day to day behaviour of the variables are not our concern, we will be taking atleast one year as a period to define the complete cycle of the company's performance. So defining rates, and levels, essential requirement for system dynamics modelling, will also be a problem..

### 4. Econometric Approach and Simulation:

Modeling by econometric approach improves one's knowledge of the market for a particular product or an entire industry

since econometric models provide us with explanatory power. On the other hand the models based on this approach enable us to evaluate the effects of alternative marketing policies on sales volume, sales revenue, and market share. We can also evaluate the effects on our market of alternative assumptions about the national economy as well as alternative policies which may be employed by our competition. Econometric models also turns out to be a simulation models on which we conduct what if simulation experiments. With simulation one can then show the corporate decision maker the consequences of the proposed managerial strategy.

There are a number of advantages to the econometric and simulation approach relative to the optimization approach and the systems approach [14].

- i) It is not necessary to assume the availability of information about management's preferences which is hard to obtain.
- ii) This approach provides the decision maker with the type of information that he or she is most likely to require in order to make decision.
- iii) With this approach one is not restricted to any particular type of model structure that may be utilized.
- iv) One does not have to assume linearity, concavity, convexity, or any of the other highly restrictive assumptions inherent in the optimization approach and to some extent also with the target variable approach.

In this approach the development of the model involves the following basic activities:

- a) Model specification in which we write dependent variables as a function of independent variables for example

$$Y = a + bX_1 + cX_2 + dX_3 \dots$$

Here the value of Y depends upon the value of  $X_1, X_2, X_3, \dots$  with parameter a, b, c, d, ... .

- b) Parameter estimation: The coefficient of independent variables a, b, c, d, ... are to be estimated after collecting the necessary historical data.
- c) Validation: The ultimate test of the validity of an econometric model is how well it forecasts the actual behavior of the system it was designed to emulate.
- d) Policy Simulation: Once we have specified, estimated and validated an econometric model then we simply change the policy variables and external variables and solve for the output variables.

## CHAPTER III

### THE COMPANY UNDER STUDY

In the previous two chapters we have discussed the prime importance of corporate planning and modelling and various methodologies for the design of the planning process. The company which is selected for study is a Woollen Textile Company in Northern India, namely British India Corporation (BIC).

#### 3.1 Background:

##### 3.1.1 Establishment:

The company was formed in 1920 for manufacture of Woollen Textile Products and have been serving the Indian markets as well as few Middle-East countries.

##### 3.1.2 Products:

The company's products are woollen based which includes:

- Woollen and worsted suitings
- Rugs, Blankets, Lohis, Shawls etc.
- Knitting yarn
- Hosiery goods (sweaters, scarves, socks etc.)

In each of the above product group the company manufactures a large number of varieties, shades, colours and designs depending upon the market requirements.

### 3.1.3 Factories and its Subsidiaries:

The company have been operating two Woollen Mills Branches:

- Cawnpore Woollen Mills Branch (CWM) under trade name of "Lal-Imli , and
- New Egerton Woollen Mills Branch (NEWM) under trade name of "Dhariwal" .

The CWM Branch is located in the heart of Kanpur city and NEWM is in Dhariwal, Punjab. The working conditions of both the Mills are almost of similar nature.

The company has investment in the following subsidiary companies and group companies. The three subsidiary companies are:

- a) Elgin Mills Co. Ltd.
- b) Brushware Limited and
- c) Shree Madhav Mills Ltd.

The group companies are:

- i) Cawnpore Textile Limited
- ii) Cawnpore Sugar Works Limited
- iii) Champarun Sugar Company Limited and
- iv) The Saran Engineering Co. Limited.

### 3.1.4 Ownership and Its Change:

The company had been operating right from the beginning as a private company and since 1979 it is working under loss.

Due to serious financial difficulties faced by the corporation during the year 1979-80, the corporation was not able to comply fully with the provisions of the Companies Rules, 1975.

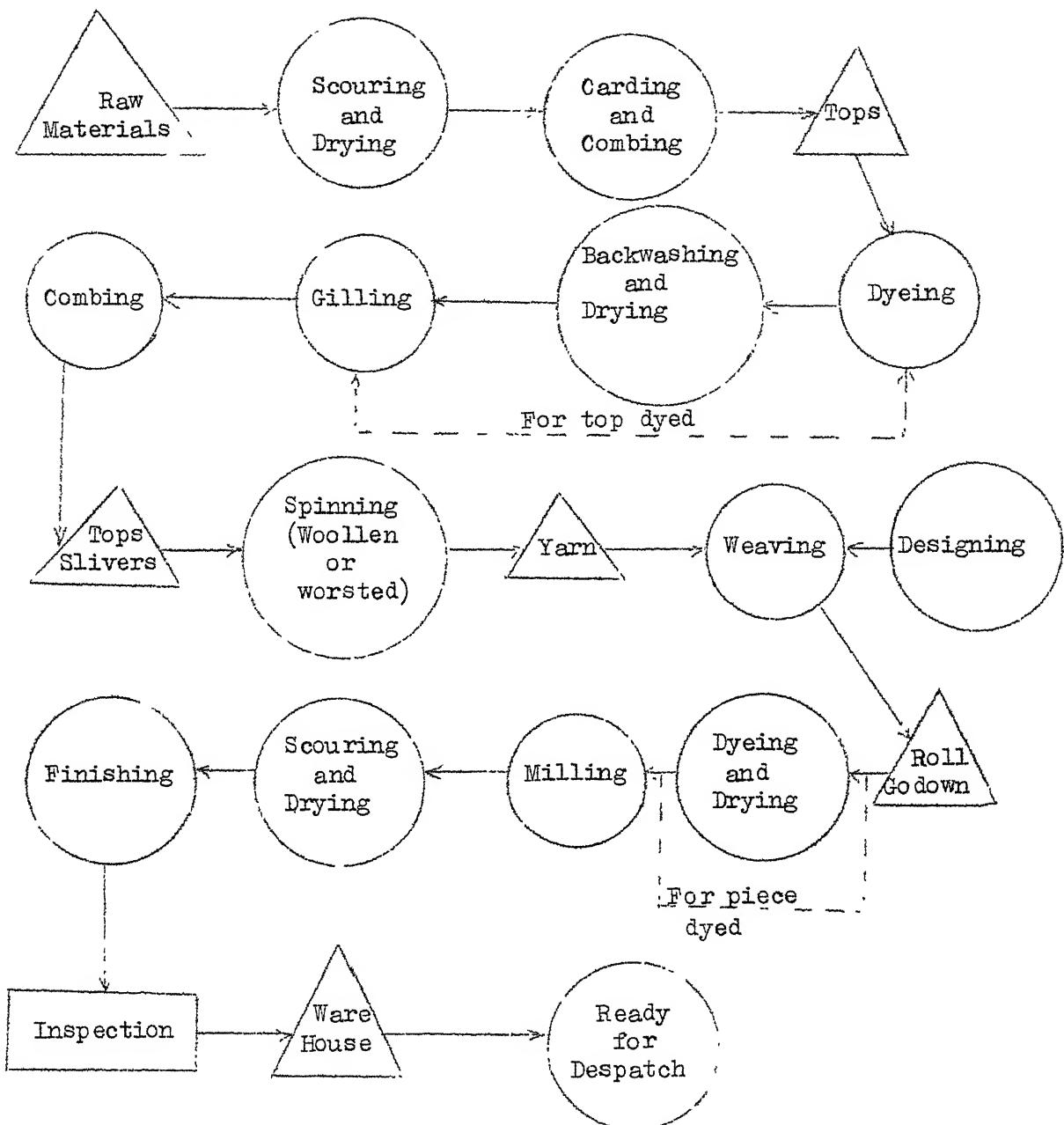
The Corporation became a government company with effect from 11th June 1981 consequent upon the promulgation of the British India Corporation (Acquisition of Shares) Ordinance 1981, which has since been changed into an act of the parliament termed as "British India Corporation Ltd. (Acquisition of Shares) Act, 1981". As a result, all the shares including preference shares and the equity shares of Rs. 100/- and Rs. 5/- respectively were acquired by the Government of India, except those shares which stand registered and owned by the nationalised banks, Life Insurance Corporation of India and Unit Trust of India.

### 3.1.5 Technology:

There are 20 manufacturing sections in the production department. Raw materials are processed through these departments to get the finished products. A generalized flow diagram of the manufacturing process is being attached here.

### 3.1.6 Machinery and Modernisation:

As the company has been working since last few decades, its machineries and equipments are considerably old and unable to produce quality goods. Damaged final products are one of the causes for the loss of sales. The management of the



→ : Transportation  
 O : Process  
 △ : Stores  
 □ : Inspection

GENERALISED FLOW DIAGRAM OF MANUFACTURING PROCESS

company has made proposals for financial assistance from Government of India for phase-wise modernisation of both the Branches.

Modernisation of worsted plant in the CWM Branch has been completed during 1981-82 except for the installation of spinning frames. The modernisation of NEWM Branch will be carried out in second phase. Management believes that modernisation of the plants and equipments will yield a quality product and, as a result, company will be able to re-establish its market.

Licenced/installed capacity (as on 1981-82)

	<u>CWM Branch</u>	<u>NEWM Branch</u>
Woollen Spindles	9336	8640
Worsted Spindles	9672	7620
Power Loom	260	240
Hand Loom	25	68

3.1.7 Employees:

Total number of employees in CWM Branch are at present 4405 and that of in NEWM Branch are 3664. Of them, about 25 percent employees are in Weaving Section, more than 12 percent are in Drawing and Spinning Section and 9-10 percent are each in Carding and Spinning and Finishing Section. The Head Office contains 62 employees. Of the total employees of the company senior staffs are about 10 percent.

### 3.1.8 Method of Marketing and Distribution Channel:

At present, almost half the company's production is sold in civilian market which covers various Bazars, Retail Shops and Cooperative Society, 30 percent products are manufactured on contract basis. 10 percent go to DGS and D (Directorate General of Supply and Disposal). Company sells the goods mostly through Sales Representatives (SR's) and Selling Agents. There are about 50 Sales Representatives in total of them 50 percent are responsible for selling the products of CWM Branch and rest 50 percent are for NEWM Branch in various regions of the country. Selling Representatives are selected each year based on the last year's performance.

Company is providing  $3 - 3\frac{1}{2}$  percent commissions to them if they meet the target of the company set in the beginning of the financial year. If some of the SRs perform badly, company selects new SRs for those regions/territories. SRs and merchants have to follow terms and conditions of the company. Merchants are getting the following trade discount on the Ex-mill prices.

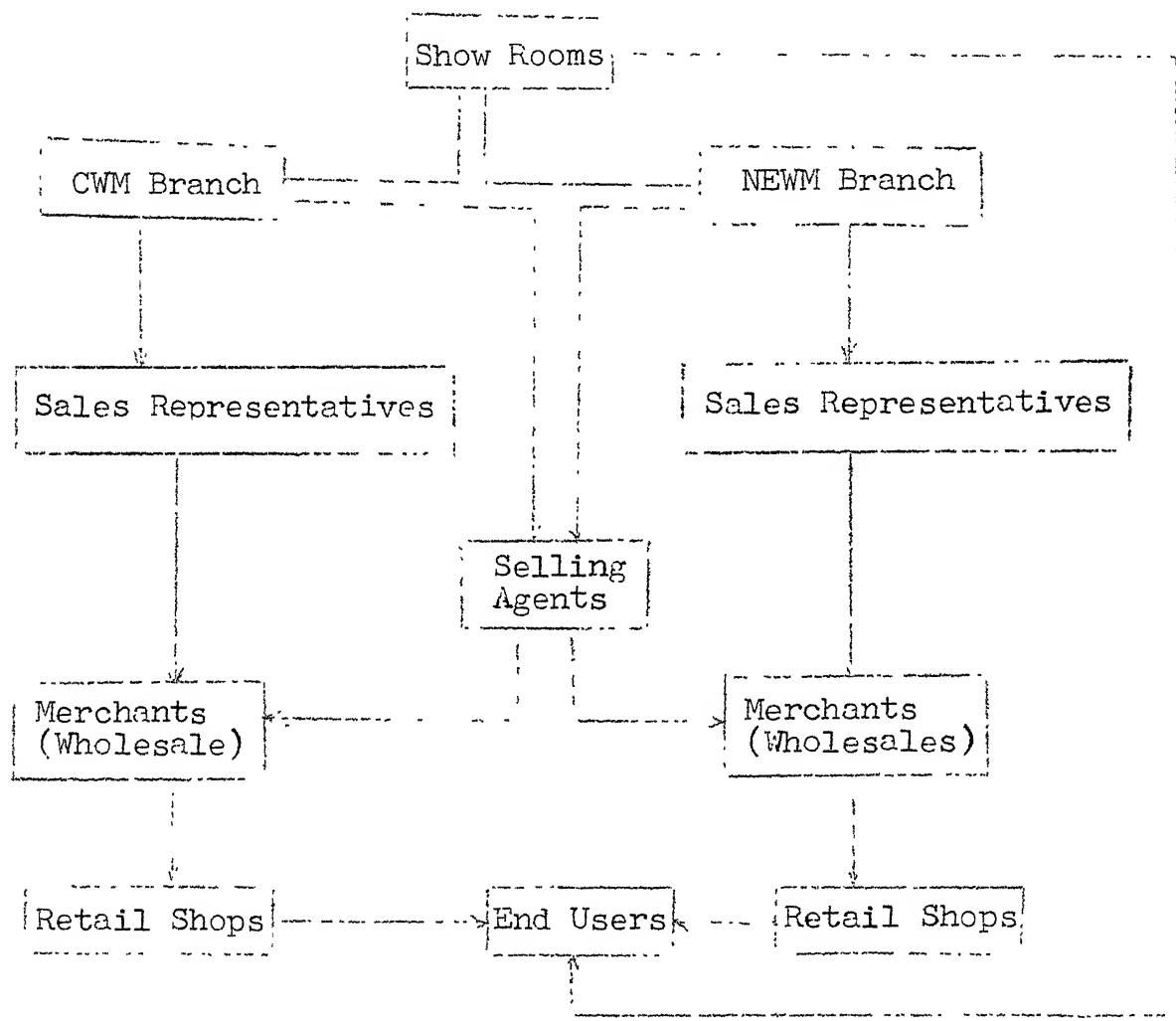
On Woollen fabrics discount is 18 percent

On Man-made fabrics discount is 10 percent

On Knitting yarn discount is 12.5 percent

Contract orders are received through proper tenders and all other orders are placed by merchants directly or through SRs, subject to confirmation and acceptance by the

company. Orders are accepted in advance, usually a few months before the start of winter. An overview of distribution channel is given below:



### 3.2 Performance:

On an average the company's financial performance over last twenty years was not very satisfactory. The company is not growing rapidly compared to other companies

in this sector. If turnover grows the profit does not grow in phase with the turnover. The company has continued to be working under loss since 1978-79 and in the early and mid-seventies the profit generated by the company was marginal and this enforced the company to bring down at this stage when the company was unable to generate surplus to continue the business. After take over by the Government, much financial aid has been given. The performance shows a marginal turnaround in the sense that company's losses came down in 1981-82.

A brief review of the turnover and profit is being given here.

Years	(in Rs. Lakhs)							
	1970	1971	1972	1973	1974	1975	1976-77	1977-78
Turnover	1134	1090	1317	1231	1644	1932	2207	1969
Net Profit	90	102	27	42	6	55	87	36
<hr/>								
Years								
Turnover	1853		1497		1539		1887	
Net Profit	-241		-523		-874		-747	

The major causes of the poor performance of the company seem to be

- high cost of production
- insufficient working capital

- lag between production plan and marketing
- interest burden
- competitors
- outdated machinery

Many other causes were responsible for poor performance in specific years.

### 3.3 Why the Company Needs Corporate Planning Model:

The top management of the company who generally involves in planning process are unable to see the performance of the company in the future. Their planning horizon is of one year only. There are many sweeping changes that affect the performance of the company under present business system, and management is either unable to anticipate these changes or at least not able to react to these changes in a timely and effective manner. If management of the company knows - what its competitors are going to do, - what policies will be enacted by the Government, - what the pricing and supply policies will be, then management need not resort to use of any planning model to plan its course of action. But rarely is management armed with even partial information about such important events. Moreover the company is unable to forecast its demand in the future. Not only that but also management is unable to see the impact of pricing policy over the demand and financial performance in the long-run.

Management is forced to muddle through as they do not have technique to formulate a model and conduct some experiments on it before going into operation of a policy.

In our opinion, the company's poor performance is attributed to a few external factors and a few internal policies. The company takes the decision and implements it and gets loss if decision is found unsuitable to the market condition. The only way to take better decision through alternative evaluation of the performance measure of the company, is to have an integrated and dynamic long-range planning model as a basic tool which responds to changes in the various factors. Thus computerised corporate planning model is essential under present condition.

## CHAPTER IV

### DESIGN OF CORPORATE PLANNING MODEL FOR BIC

#### 4.1 The Methodology Chosen and Why:

In Chapter II, few methodologies have been discussed with advantages and limitations. The approach which is very convincing and has got explanatory power is the Econometric Approach. The method is self-explanatory because it say how strongly or poorly one independent variable is related to the dependent variable and make understanding the model very simple. If the management wants to conduct computer simulation experiments to evaluate the effects on for example, turnover or market share of alternative pricing, advertising, and competitive strategies, then econometric methodology is the appropriate analytical tool. It can be used to link company's market forecast to national economic indicators. Management can enhance its ability to see the behavior of variables and their effects on the performance of the model.

#### 4.2 The Basic Thrust of the Model:

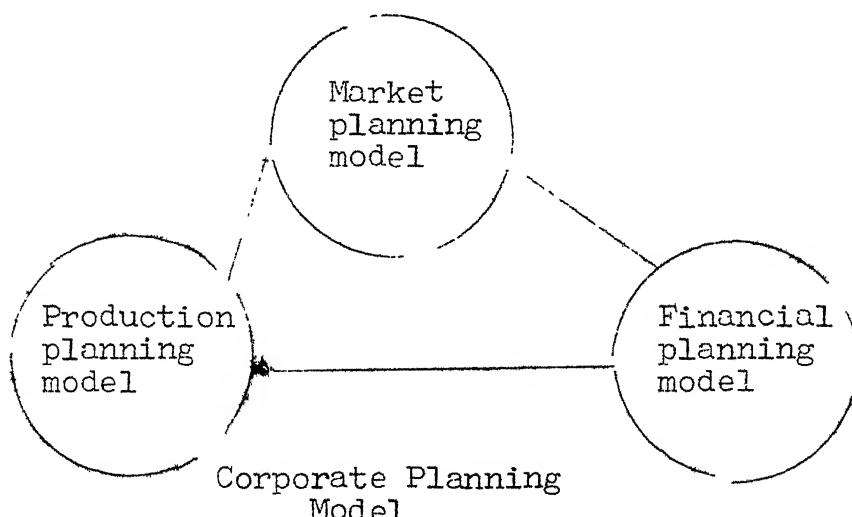
The emphasis has been given to study the woolen market and its future potentials in the country. Three major product groups of the woolen products have been considered in this study, viz. woollen and worsted suitings, rugs, blankets,

shawls etc. and knitting yarn. To study the total woollen market all the six major woollen textile companies have been taken into consideration. They are:

1. Shree Digvijaya Woollen Mills Ltd.
2. Shree Dinesh Mills Ltd.
3. Modella Woollen Ltd.
4. Raymond Woollen Mills Ltd.
5. Oriental Carpet Manufacturing India Ltd.
6. British India Corporation Ltd.

After study the total market, the company's market of woollen textile has been studied in detail. The reason behind the study of the woollen market is that because market determines the production quantity to be sold in the near future and based on the market demand, planning for production and need of finance can be worked out.

Then we have worked out production and financial planning in the integration with the market planning.



This is a dynamic system in which outcome of the planning effort essentially contributes to changes in the situational factors or management's risk-taking willingness. For the sake of company's better planning decision the model's design parameters must go under timely updating and improvement using up-to-date informations.

#### 4.3 Marketing Sub-Model for Planning:

These models provide us the forecast for the Woollen market demand and market shares of the company. This is obviously required for long term investment and production planning. Moreover, after careful analysis of the company's past and present financial conditions, we find a large chunk of money is blocked in the excess inventory and for that interest charge is quite considerable. If the company is able to forecast the demand for the product-group roughly, if not precisely, then excessive inventory can be brought down to some desirable level and in doing so interest charges can be reduced to a great extent. Here our major efforts go to the marketing models, sales/demand forecastings in particular, which are of utmost important for the company. Firstly we will study the total woollen market in India considering major woollen textile mills then we will switch over to the company's market for her product-groups and her market shares for each product-group. The factors which are affecting the market demand as well as company's demand have been considered in details and will be discussed in

Chapter . . . Therefore we are developing econometric models which relate the various factors or variables namely exogenous, endogenous and policy variables.

A model diagram for market planning is being attached here.

#### 4.4 Production Sub-Model:

Production planning models are much more complex than marketing and financial planning models, as production planning is often done at operational levels. Here our interest is only to see few major parts of the production systems. Product-wise sales forecast is generated by the marketing planning model for the company. We will see how much will it cost to produce that amount to satisfy the market demand. Variable costs, other manufacturing costs, fixed costs and costs of production are of prime importance at corporate level planning. In addition, opening and closing inventories at desired level, total inventories and cost-of-goods sold are also important for our study. So our production planning models will generate the cost-of-goods sold for each product-group. Other aspects of production planning are entirely dependent on the operational planning, for example, weekly or monthly scheduling of particular product line depending upon various production constraints and effective resource utilization.

A model diagram for production planning is being attached here.

#### 4.5 Financial Sub-Model:

The financial planning models are dynamically chained with the production and marketing planning models. The purpose of these models would be to provide quantitative estimates of various accounting and financial relationships/measures based on specific decisions by the management. The models produce financial statements viz. income statement , balance sheet and financial indicators etc. In these models projections of selling quantity of each product-group and cost-of-goods-sold are coming as input data from the marketing models and production models respectively. Models have capability to simulate the effects of alternative financial policies and assumptions about the company's external environment on the financial performance of the company. Here we are dealing with exogenous, endogenous and policy variables. The interest of the company, who wants to survive in the present market, goes to few endogenous variables - gross profit, market share, sales growth, and total equity.

A model diagram of financial planning is being attached here. In the next Chapter we will discuss the variables of our considerations.

#### 4.6 Model Diagrams:

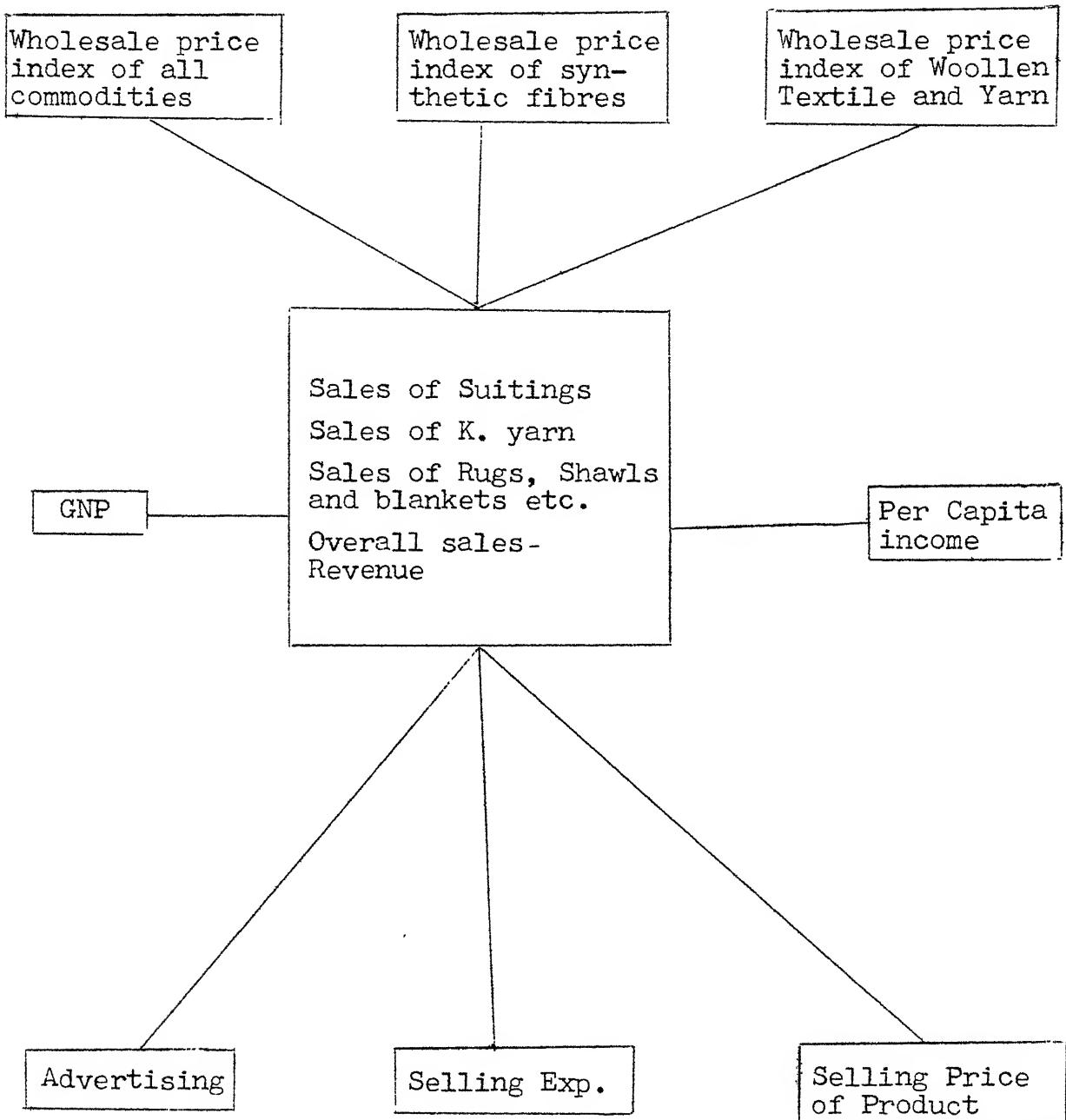


DIAGRAM OF MARKET SUB-MODEL

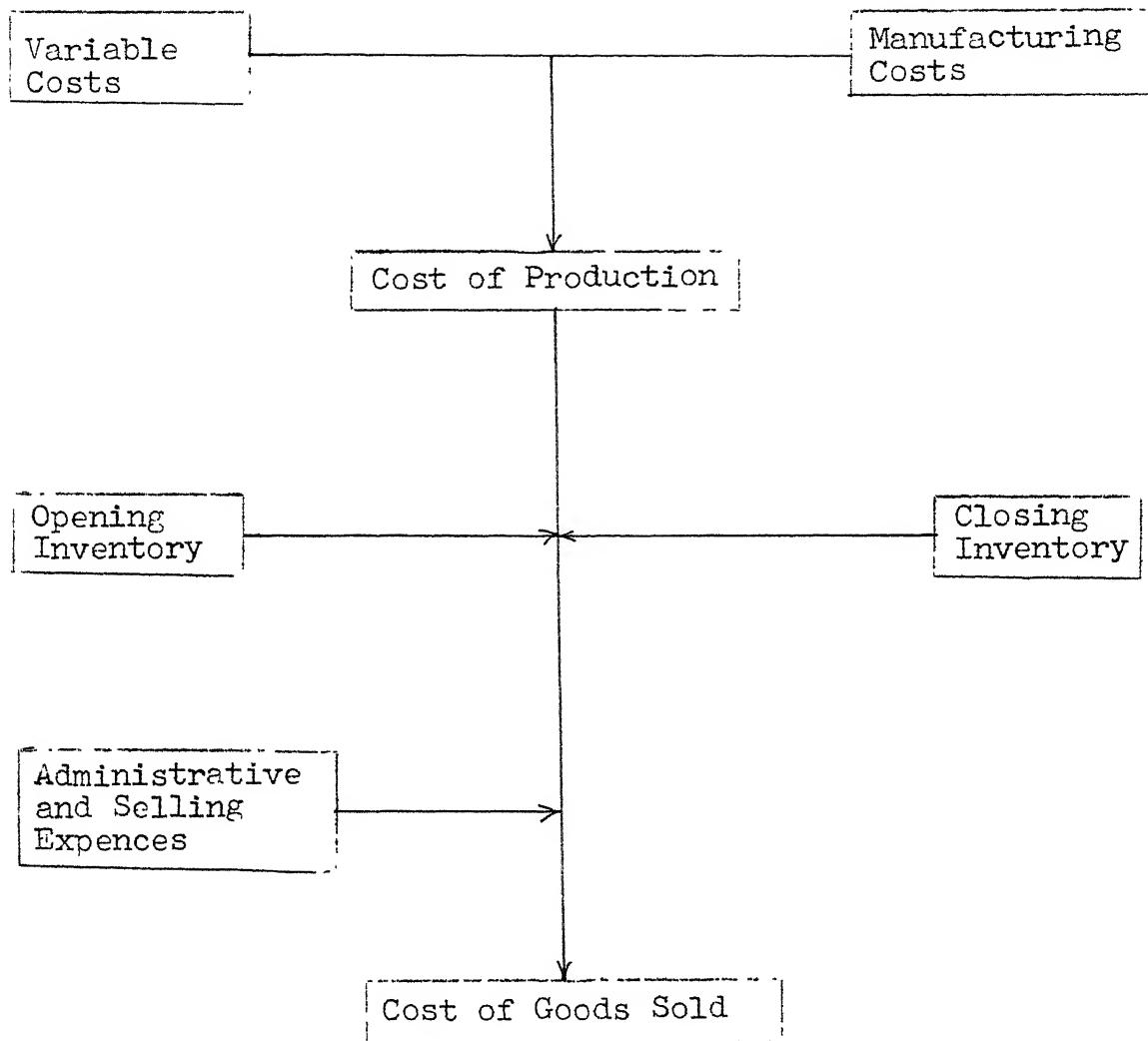


DIAGRAM OF PRODUCTION SUB MODEL

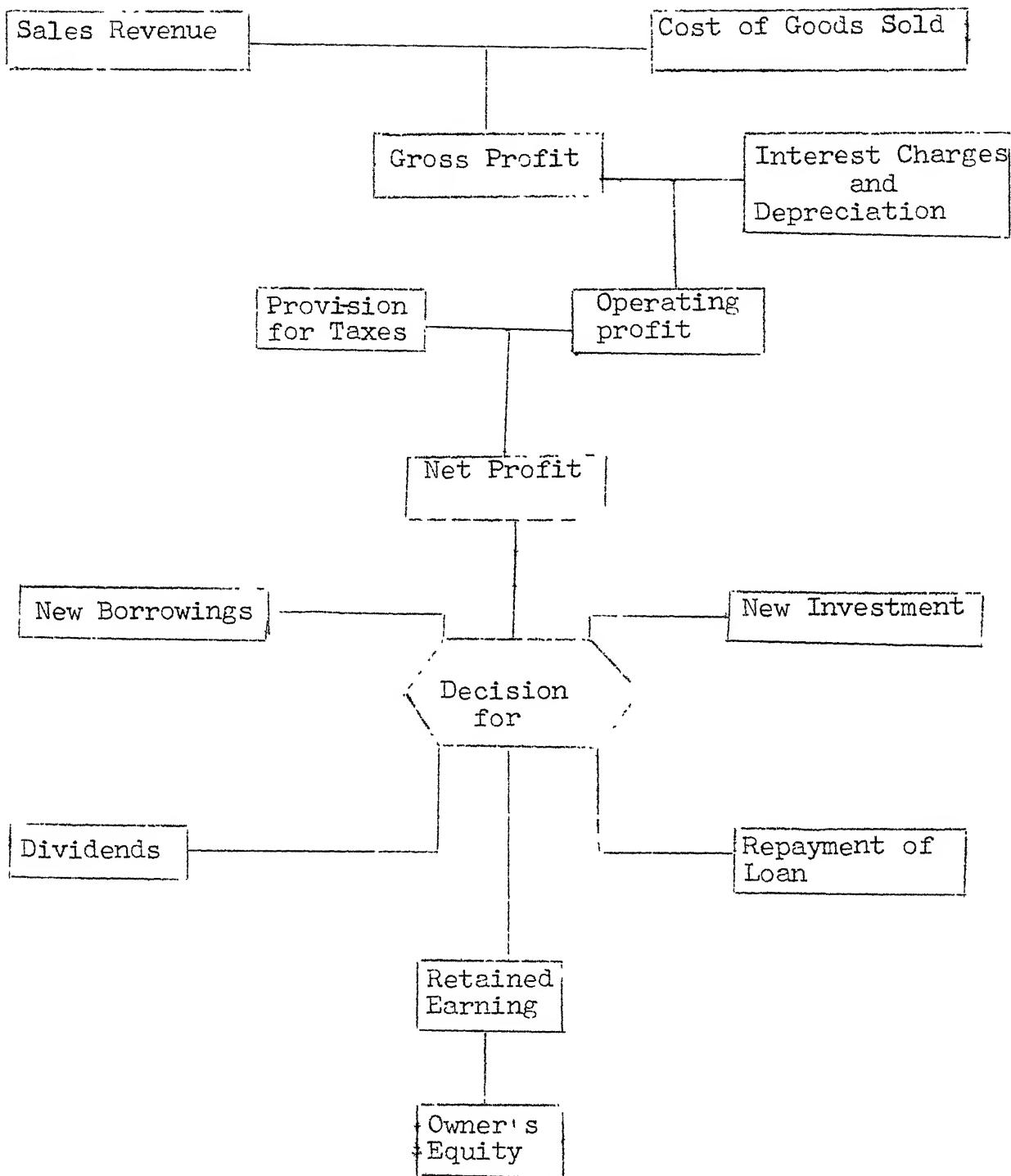


DIAGRAM OF FINANCIAL SUB-MODEL

## CHAPTER V

### DATA COLLECTION AND ANALYSIS

The collection of useful informations from the company is a key task for the study of the real-life situation. Exploration of rare but relevant data is indeed a difficult task, if not impossible. The degree of accuracy of analysis depends on the availability of relevant informations for the analysis. One of the major problems in developing an econometric model is the difficulty in obtaining the required data. The way in which data have been collected and informations explored for this analysis cannot be expressed in words. Considerable amount of effort and time have been given to gather the data from the company. The collected informations consist of published data as well as unpublished data. The verbal informations have also been collected from time-to-time through special discussions with the managers and officers in respective areas. Informations of National economic indicators have been obtained from the Govt. publications.

#### Data Sources:

1. Annual Reports of the Company (from 1970 - 1981-82)
2. Stock Exchange Official Directory
3. Index Number of Wholesale prices, centre for Monitoring Indian Economy

4. Reserve Bank of India Bulletin.
5. Wholesale price list of the Company.
6. Unpublished information.
7. Direct discussions.

#### 5.2 Estimation of Model Relationships:

Conceptual models of each category were developed and the data were used to estimate parameters of the models under the constraints of statistics. A large number of models have been tested on computer in quest of better predictable factors relevant to the models. A brief description of what different variables were tried and how the best relationships were chosen, is given below.

The parameters have been estimated using least-square step wise Multiple Linear Regression technique (SPSS package is used which is installed in DEC 1090 system). The form of relationships tested were additive linear and in most of the cases and multiplicative and log linear in few cases.

In the marketing model:

- a) GNP at current prices, GNP at constant prices, per capital income, and wholesale price index ratio and its meaningful combinations have been taken as independent variables for total market sales of woollen. The best relationships of maximum  $R^2$  value has been selected under constant supervision of F-values, T-values and sign of coefficients of

variables. So that rationality and statistical significant measures can be maintained throughout.

- b) Similarly for the total market suitings the following variables and their meaningful combinations have been tested to choose the best relationships of highest  $R^2$  under statistical and intuitive constraints. The independent variables are - GNP, per capita income, wholesale price index of Woollen, and that of synthetic yarn and their ratios with general whole sale price index.
- c) Similar exercise have been carried out for establishing the best relationships of independent variables with dependent variables for the total market sales of knitting yarn, company's knitting yarn, company's rugs, blanket and shawls etc. and so and so forth.
- d) But in few cases, for example,
  - i) Market total sales of rugs, blankets and shawls etc.
  - ii) Total market sales of Hosiery,
  - iii) Company's sales of suitings and
  - iv) Company's sales of hosiery,

We are unable to develop good relationships only due to unavailability of relevant data about external environment. More than hundred relationships have been tested in total and the best relationships have been chosen for final consideration.

- e) In the financial model too we successfully tried to make the model for interest payment considering long-term interest, interest on inventory under different interest rate structure in the last 12 years.
- f) We have made the econometric models for all the National Economic Indicators for our use, considering time as independent variable. The projected values from those models have been used in later part of the model wherever required.
- g) For rest part of the model, which includes production planning and financial planning identities and accounting equations all are recursively related have been written.

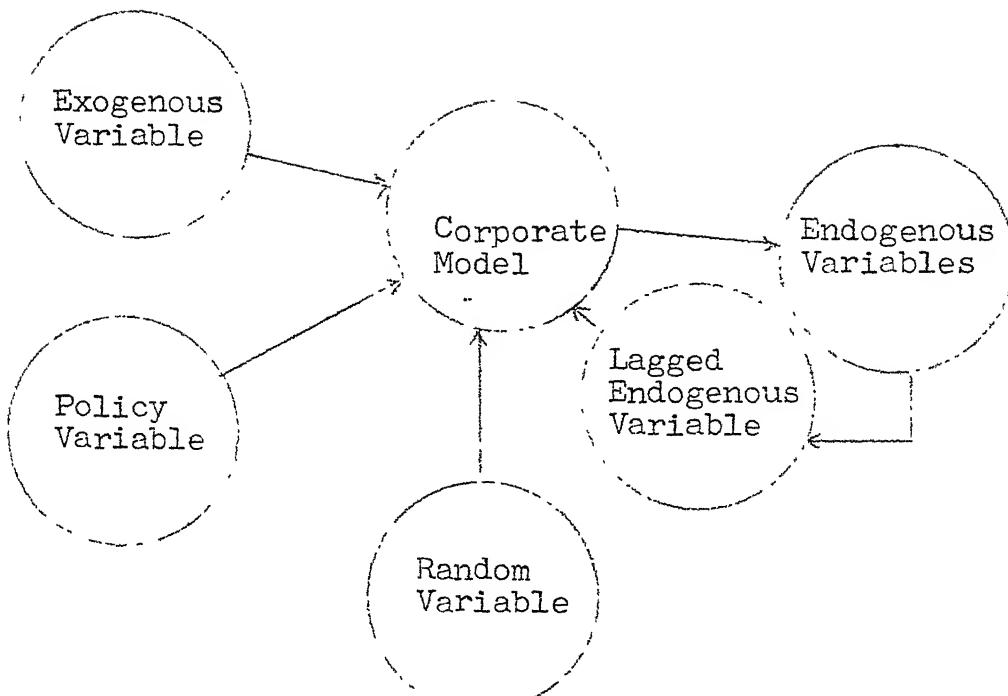
## CHAPTER VI

### THE OVERALL MODEL SPECIFICATION

#### 6.1 Descriptions of Variables:

The corporate model consists of a set of endogenous variables, we can call them either output variables, response variables or dependent variables, and a set of exogenous variable and policy variables viz. input variables. We are also dealing with lagged endogenous variables to make the model dynamic and more realistic and to have some sort of control. Exogenous variables are out of control for the management of the company e.g. competitor's strategies, Government policies, national economic indicators and any disasters etc. Policy variables are under the control of the company. Endogenous variables indicates something by which management judges the performance of the company and these variables are controlled by exogenous variables and policy variables. There are few variables over which company has partial control, for example, market share.

Therefore in the corporate model the endogenous variables will be the function of exogenous variables, management policy variables, lagged endogenous variables plus random variables.



Now we present the variables under different categories which we have incorporated into the models. The models have been programmed on Computer (DEC System 1090 available at IIT Kanpur) in FORTRAN language. The variables have been coded according to the FORTRAN language and are being given below with descriptions and their units under parentheses.

Endogenous variables like Total Woollen Market, market sales of various product are being considered as exogenous variables to the company's corporate modelling systems.

#### EXOGENOUS VARIABLES:

<u>Variable's Code</u>	<u>Descriptions (Units)</u>
CPI	Consumer Price Index (1960 = 100)
GNPC	GNP at Current Prices

<u>Variable's Code</u>	<u>Descriptions (Units)</u>
OTHINC	Other Incomes (Rs. Lakhs)
IR	Bank Interest Rate
PCI	Per Capita Income (Rs. at constant price 1970-71)
TMS	Total Woollen Market Sales (Rs. Crores)
TMSU	Total Market Suitings (K mtrs.)
TMY	Total Market Yarn (Tonnes)
VCY	Variable Costs for Yarn (Rs./Kg.)
VCRB	Variable Costs for Rugs and Blankets (Rs./pc)
VCSU	Variable Costs for Suitings (Rs./mt.)
WPIG	Wholesale Price Index (General Commidities at 1970 = 100)
WPIW	Wholesale Price Index (Woollen Textile and Yarn at 1970 = 100)
WPIS	Wholesale Price Index (Synthetic Yarn at 1970 = 100)
TIME	Time (1970 = 1)

#### ENDOGENOUS VARIABLES

<u>Variable's Code</u>	<u>Descriptions (Units)</u>
CS	Company's net sales (Rs. Crores)
CRB	Company's Rugs and Blankets (,000 pcs)
CY	Company's Yarn (Tonnes)
CSU	Company's Suitings (KMTs)
CPROD	Cost of Production (Rs. Lakhs)
CGS	Cost of Goods Sold (Rs. Lakhs)

<u>Variable's Code</u>	<u>Descriptions (Units)</u>
CINV	Closing Inventory of Finished Goods (Rs. Lakhs)
OINV	Opening Inventory of Finished Goods (Rs. Lakhs)
VCOST	Variable Costs of Production (Rs. Lakhs)
MCOST	Other Manufacturing Costs (Rs. Lakhs)
FCOST	Other Fixed Costs of Production (Rs. Lakhs)
WAGES	Wages and Salaries (Rs. Lakhs)
SALREV	Sales Revenue from the Goods Sold (Rs. Lakhs)
TSREV	Total Sales Revenue Including Other Incomes (Rs. Lakhs)
GPROFT	Gross Profit (Rs. Lakhs)
OPROFT	Operating Profit (Rs. Lakhs)
NPROFT	Net Profit (Rs. Lakhs)
GASSET	Gross Assets (Rs. Lakhs)
CASSET	Current Assets (Rs. Lakhs)
NASSET	Net Assets (Rs. Lakhs)
OASSET	Other Assets (Rs. Lakhs)
TASSET	Total Assets (Rs. Lakhs)
CLIA	Current Liabilities (Rs. Lakhs)
TLIA	Total Liabilities (Rs. Lakhs)
TAX	Tax Provision (Rs. Lakhs)
INTST	Interest Charges (Rs. Lakhs)
DEP	Cumulative Depreciation (Rs. Lakhs)
DEPY	Depreciation for the Year (Rs. Lakhs)
DIVIDT	Dividends Payment (Rs. Lakhs)
RE	Retained Earnings (Rs. Lakhs)

<u>Variable's Code</u>	<u>Descriptions (Units)</u>
OE	Owner's Equity (Rs. Lakhs)
CRAT	Current Ratio
GPRAT	Gross Profit Ratio
OPRAT	Operating Profit Ratio
ROA	Return on Assets
LTLOAN	Long-Term Loan (Rs.Lakhs)
TINV	Total Inventories (Rs. Lakhs)
ATINV	Average Inventory Level (Rs. Lakhs)
NMI	Number of Months for Work-in-process Inventory/year
MSHSU	Market Share of Suitings
POLICY VARIABLES	
<u>Variable's Code</u>	<u>Descriptions (Units)</u>
PY	Price of Yarn (Rs./Kg.)
PRB	Price of Rugs and Blankets (Rs./pc)
PSU	Price of Suitings (Rs. /mtr.)
ADVT	Advertising Expenditure (Rs. Lakhs)
SEXP	Selling Expenses (Rs. Lakhs)
INVST	Investment in Securities (Rs. Lakhs)
NIF	New Investment in Fixed Assets (Rs. Lakhs)
ALOAN	Additional Loan (Rs. Lakhs)
REPAY	Repayment of Loan (Rs. Lakhs)
DEVRAT	Divident Rate
NMC	No. of Months of Closing Inventory of Finished Goods/year
NMR	Average No. of Months of Raw Materials and Spare Parts Inventory/Year

## 6.2 Specifications of the Model's Equations:

### Models for the National Economic Indicators

$$WPIG_t = 77.7 + 15.136 * TIME, \quad R^2 = 0.934$$

(1.268)

$$WPIW_t = 96.6 + 13.38 * TIME, \quad R^2 = 0.9164$$

(1.278)

$$WPIS_t = 84.27 + 11.05 * TIME, \quad R^2 = 0.9440$$

(0.85)

$$GNPC_t = 31239.77 + 2499.5 * TIME + 327.68 * TIME^2, \quad R^2 = 0.986$$

(1180.5) \quad (88.4)

$$PCI_t = 596.0 + 10.2 * TIME, \quad R^2 = 0.737$$

(1.92)

$$CPI_t = 162.4 + 22.0 * TIME, \quad R^2 = 0.924$$

(2.0)

### MARKETING SUB-MODEL

$$TMS_t = -26.2 + 16.237 * GNPC_{t-1}, \quad R^2 = 0.9866$$

(0.00006)

$$TMSU_t = -11115.8 + 38.17 * PCI_t + 20.91 * WPIS_t, \quad R^2 = 0.962$$

(6.17) \quad (5.9)

$$TMY_t = 1161.28 - 9.69 * PY_t + 5.814 * WPIS_t, \quad R^2 = 0.69$$

(2.53) \quad (2.3)

$$CY_t = -191.87 - 1.03 * PY_t + 485.17 * WPIS_t / WPIG_t, \quad R^2 = 0.7613$$

(0.407) \quad (276.7)

$$CRB_t = 477.53 - 6.245 * PR_t + 5.834 * SEXP_{(t-1)} + 22.836 * ADVT_{(t-1)}$$

(1.947) \quad (2.34) \quad (6.97)

$R^2 = 0.665$

$$CSU_t = MSHSU_t * TMSJ_t$$

\* Figures in brackets are the standard errors.

## PRODUCTION SUB-MODEL

$$\begin{aligned}VCOST_t &= (CY_t * VCY + CRB_t * VCRB + CSU_t * VCSU) * WPIW_t / WPIW_{t=1} \\MCOST_t &= FCOST_t + WAGES_{t=1} * CPI_t / CPI_{t=1} \\CPROD_t &= VCOST_t + MCOST_t\end{aligned}$$

$$CINV_t = NMC_t * CPROD_t / 12$$

$$CGS_t = CPROD_t + SEXP_t + OINV_t - CINV_t$$

$$OINV_{t+1} = CINV_t$$

$$\begin{aligned}TINV_t &= (NMC_t * CPROD_t + NMW_t * (VCOST_t + \frac{1}{2} MCOST_t) + \\&\quad + NMR_t * VCOST_t) / 12\end{aligned}$$

$$ATINV_t = TINV_t / 2$$

## FINANCIAL SUB-MODEL

### Income Statement Model

$$\begin{aligned}SALREV_t &= CY_t * PY_t + CRB_t * PRB_t + CSU_t * PSU_t \\TSREV_t &= SALREV_t + OTHINC_t \\GPROFT_t &= TSREV_t - CGS_t \\INTST_t &= 6.237 + 0.0149 * LTLOAN * IR_t + 0.0103 * ATINV_t * IR_t, \\&\quad R^2 = 0.985 \\OPROFT_t &= GPROFT_t - INTST_t - DEPY_t \\TAX_t &= TAXRAT_t * OPROFT_t \\NPROFT_t &= OPROFT_t - TAX_t \\DIVIDT_t &= NPROFT_t * DIVRAT_t \\RE_t &= NPROFT_t - DIVIDT_t \\OE_t &= OE_{t-1} + RE_t\end{aligned}$$

## BALANCE SHEET MODELS

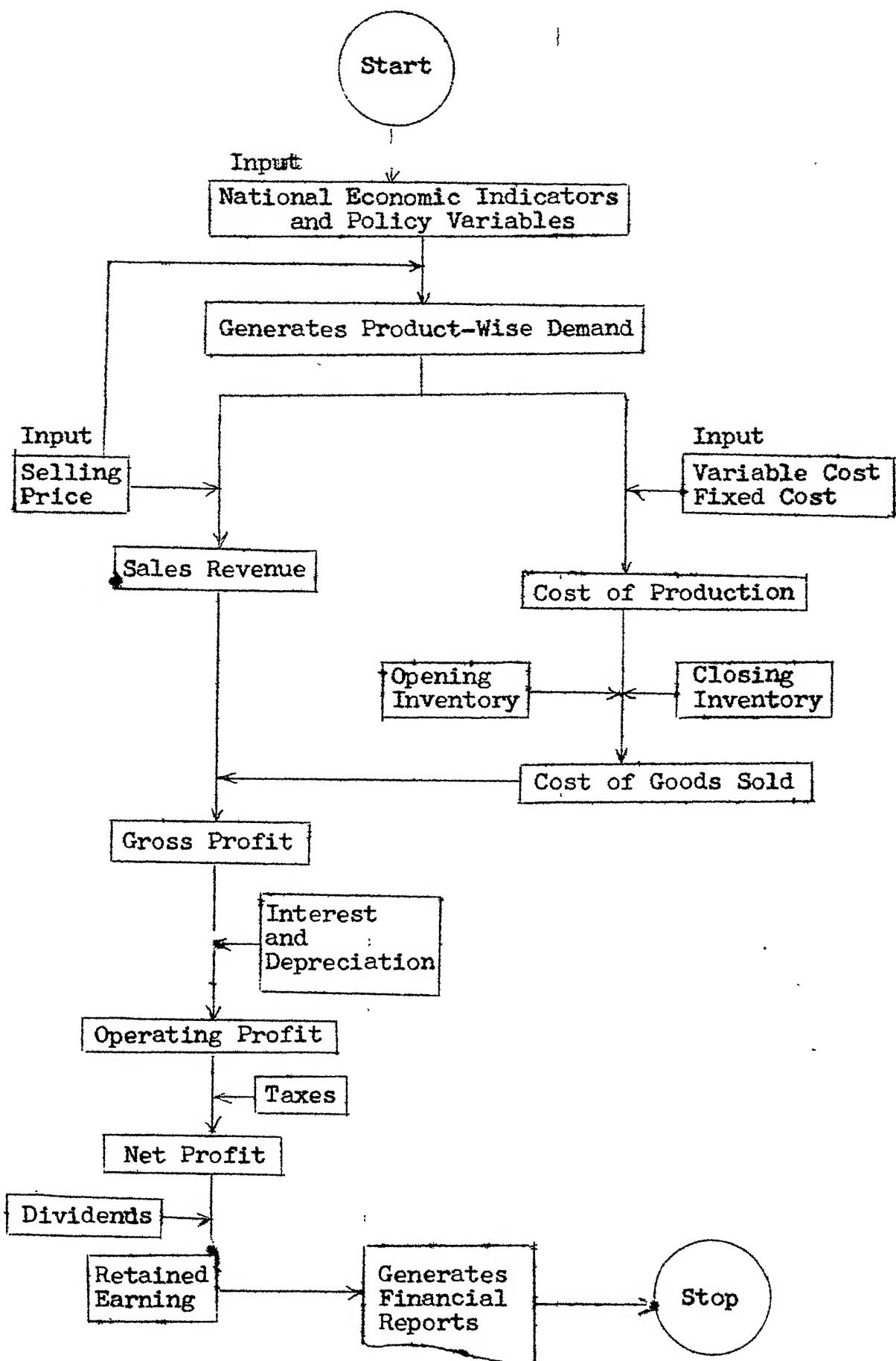
$$\begin{aligned}
 \text{GASSET}_t &= \text{GASSET}_{t-1} + \text{NIF}_t + \text{ALOAN}_t \\
 \text{DETY}_t &= \text{DEPRAT} * \text{GASSET}_t \\
 \text{DEP}_t &= \text{DEP}_{t-1} + \text{DEPY}_t \\
 \text{NASSET}_t &= \text{GASSFT}_t - \text{DEP}_t \\
 \text{INVST}_t &= \text{INVST}_{t-1} \\
 \text{CASSET}_t &= \text{TINV}_t + \text{OASSET}_t \\
 \text{TASSET}_t &= \text{NASSET}_t + \text{CASSET}_t + \text{INVST}_t \\
 \text{LTLOAN}_t &= \text{LTLOAN}_{t-1} + \text{ALOAN}_t - \text{REPAY}_t \\
 \text{CLIA}_t &= \text{TASSET}_t - \text{LTLOAN}_t - \text{OE}_t \\
 \text{TLIA}_t &= \text{CLIA}_t + \text{LTLOAN}_t
 \end{aligned}$$

## FINANCIAL RATIO MODELS

$$\begin{aligned}
 \text{CRAT}_t &= \text{CASSET}_t / \text{CLIA}_t \\
 \text{GPRAT}_t &= \text{GPROFT}_t / \text{SALREV}_t \\
 \text{OPRAT}_t &= \text{OPROFT}_t / \text{SALREV}_t \\
 \text{ROA}_t &= \text{NPROFT}_t / \text{TASSET}_t \\
 \text{RTINV}_t &= \text{TINV}_t / \text{TSREV}_t \\
 \text{RINV}_t &= \frac{1}{2} * (\text{OINV}_t + \text{CINV}_t) / \text{TSREV}_t
 \end{aligned}$$

### 6.3 Assumptions:

- Prices of major product-group are average prices ignoring the different prices against different design and variety in each group.
- The company's sales of hosiery is omitted from our model because of unavoidable difficulty and also it has only minor contribution to the company's performance.
- For the Company's sales of suitings we are considerin market share as a policy variable. Reason is (i) we could not develop powerful relationships due to nonavailability of relevant information, (ii) company wants to cover a stable market in suitings which is company 's main product.
- Production planning is broadly carried out irrespectiv<sup>r</sup> of production constraints.
- Financial statements are made in the absence of few micro-policies for example, investment, etc.
- Any estimates of nonquantifiable factors have not been considered in this model.
- The factors which were responsible to some extent for the fluctuation in performance of the company have not been considered because those factors of unpredictable nature and they are nonquantifiable for example, consumer resistance, fire, drought etc.



FLOW CHART OF COMPUTERIZED CORPORATE PLANNING MODEL

#### 6.4 Validation:

Validation is one of the difficult part of the model building. Validation of model is possible only when history of data is available. One can validate the complete model if few more data is made available. Here we will try to validate at least econometric model for marketing. The validation of econometric model includes three basic steps:[12]

1. Rationalism: According to this the model relationships must be sound, logically and intuitively appealing, and should be based on sensible assumptions.
2. Empiricism: Where we examine test statistics  $R^2$ , T-statistics, F-statistics, and Durbin-Watson statistics.
3. Prediction: is probably most powerful test of the validity of a computer simulation model, that is, if model is consistent able to forecast the behavior of endogenous variables with a high degree of accuracy then our confidence in validity of the model increases [13].

According to Friedman, the validity of a model depends not on the validity of the assumptions on which the model rests but on the ability of the model to predict the behavior of the dependent variables that are treated by the model [12].

Since no actual future data can be available for which model is made to forecast for future, so in first step we can do Ex-post validation i.e. how accurately the model has predicted the past. In some sense, once we have validated the

model on an ex-post basic it becomes an act of faith that model can exhibit the similar behavior in the future but there is no assurance for that. Our econometric or behavioural equations are based on the sound economic theory and relations are consistent. All the statistics viz. F, T, DW and R<sup>2</sup> are reliable. Ex-post validation i.e. predicted values have been shown on graph in broken line, and tables are in Appendix. Further we can use Goodness of fit test for validating the forecasting performance of econometric model.

There are many tests for the Goodness of fit, like

1. Kolmogorov-Smirnov Test
2. Chi-Square Test
3. Spectral Analysis
4. Mean Percent Absolute Error
5. Theil's Inequality Coefficient

Here, we are using the last two test for validating the model.

$$\text{Mean Percent Absolute Error} = \frac{1}{n} \sum \left| \frac{P_i - A_i}{A_i} \right|$$

where  $P_i$  denotes the predicted value generated by the model and  $A_i$  denotes the corresponding actual value of the variable. This indicates the reliability of the prediction.

Theil's inequality coefficient U which measures the degree to which an econometric model provides retrospective predictions  $P_i$  of observed historical data  $A_i$ .

$$U = \frac{\sqrt{\frac{1}{n} \sum (P_i - A_i)^2}}{\sqrt{\frac{1}{n} \sum P_i^2} + \sqrt{\frac{1}{n} \sum A_i^2}}$$

If  $U = 0$ , we have perfect predictions. If  $U = 1$ , we have very bad prediction. In our case  $U$  values for all the behavioral equations are very close to zero, this means the predictability of the model is statistically good.

Apart from this we have calculated Mean Absolute Deviation (MAD) just to see the variability of the predicted values.

Table is being given below which includes the above tests.

#### GOODNESS OF FIT TESTS

	MAD	Percent Abs.Error	Theil's Test
Total Market Sales of Woollen (Rs. Crores)	3.4	0.045	0.0246
Total Market Suitings (K meters)	275.9	0.034	0.0195
Total Market Knitting Yarn (Tonnes)	153.1	0.127	0.0692
Company's Knitting Yarn (Tonnes)	28.3	0.240	0.0936
Company's Rugs and Blankets etc. (,000 pcs)	73.4	0.114	0.0717

## CHAPTER VII

### GUIDELINES FOR USE OF THE MODEL

#### 7.1 What This Model Can Do:

The model can be used after providing some basic data as input to the model. Model takes variables (or actions) over which management has direct control, for example price, selling expenses, inventory etc. as a policy variables and project those over which management has either indirect control or no control, for example sales, market share etc.

It predicts the total market sales of Woollen products in Rs. crores and Sales in quantity by product category. It also predicts the Company's sales in Rs. Lakhs and price in Rs./Unit, and sales in quantity by product category. From these, it proceeds to compute total cost of production if the predicted sale, are to be manufactured, and inventory levels according to inventory policy.

Then it systematically projects all the basic financial aspect under the proposed circumstances. It generates the income statement, balance sheet and financial ratios for the action management wish to take. Then after feeding more than one set of actions one can very well compare the result, and financial impacts of the decisions.

Model can be used for long-run planning and short-run (but not less than a year) planning as well. As soon as new information is made available user can change the values of the basic parameters and can get the congruent results for future.

### 7.2 Data Input to the Model:

The following data should be furnished by the user to start with the model.

M	:	Time horizon in no. of years for which the response is to be generated
PRY	:	Current average price of Knitting Yarn (Rs./Kg.)
PRB	:	Current Average Price of Rugs and Blankets (Rs./pc)
PSU	:	Current Average Price of Suitings (Rs. /mtr.)
VCY	:	Variable Cost of Knitting Yarn (Rs./Kg.)
VCRB	:	Variable Cost of Rugs and Blankets (Rs./pc)
VCSU	:	Variable Cost of Suitings (Rs./mtr.)
ADVT	:	Proposed Annual Advertising Expenditure (Rs. Lakhs)
SEXPL	:	Proposed Annual Selling Expenses (Rs. Lakhs)
GASSET	:	Gross Assets in Previous Year (Rs. Lakhs)
OASSET	:	Other Assets in Previous Year (Rs. Lakhs)
WAGES	:	Wages and Salaries in Previous Year (Rs. Lakhs)
FCOST	:	Fixed Cost in Previous Year (Rs. Lakhs)
OINV	:	Opening Inventory (Rs. Lakhs)
OE	:	Owners Equity in Previous Year (Rs. Lakhs)

DEP : Cummulative Depreciation till Last Year (Rs. Lakhs)

DEPRAT : Average Depreciation Rate (in fraction)

IR : Interest Rate (percent)

INVST : Investment in securities (Rs. Lakhs)

LTLOAN : Long Term Loan in Previous Year (Rs. Lakhs)

NIF : Any Adaitional Investment on Fixed Assets (Rs. Lakhs)

MSHSU : Market Share (in fraction)

IPY : Proposed Annual Increase in Price of Knitting  
Yarn (in fraction)

IPRB : Proposed Annual Increase in Price of Rugs and Blank.  
(in fraction)

IPSU : Proposed Annual Increase in Price of Suitings  
(in fraction)

TAXRAT : Tax Rate (in fraction)

REPAY : Proposed Annual Loan Repayment (Rs. Lakhs)

## CHAPTER VIII

### EXPERIMENTS WITH THE MODEL, RESULTS AND LIMITATIONS

#### 8.1 Selections and Implications of the Scenarios [18]:

The purpose of a scenario is to examine company's operations and objectives within any given environment. In selecting scenarios, it is necessary to make some reasonable or fairly likely assumption about the company and its environment. The development of scenarios is a part of objective-setting and decision making process. It provides a means for evaluating potential strategies with respect to the company's goals in several different but probable futures. Each set of strategies can have three possible outcomes:

- a) The company just meets its objectives in all the scenarios considered. This suggests that the objectives are realistic.
- b) The company fails to meet its objectives in all the scenarios considered. This suggests that the management has failed to understand its own operational capabilities, it has set unrealistic objectives, it has failed to understand its environment or a combination of these.

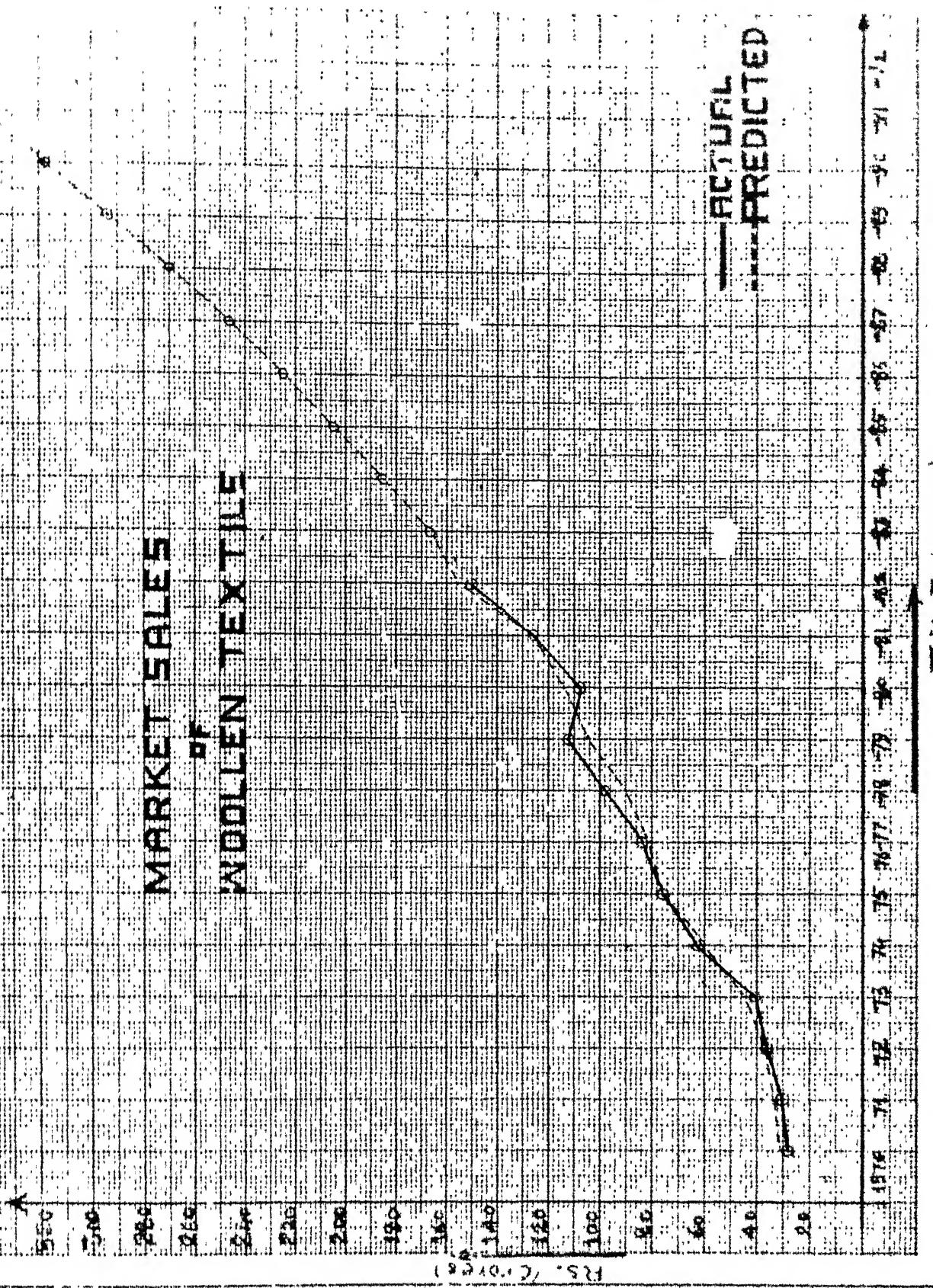
c) The company fails to meet its objectives in some of the scenarios. This suggests that the management has set realistic objectives in the scenarios which succeeded but that its objectives were unrealistic in these scenarios in which it failed.

We have considered five alternative sets of strategies based on the company's realistic assumptions. These lead to five different scenarios of future predicted by our model. All five scenarios are given in Appendix. Here we are giving the aspects of policy on which each scenario is based.

#### Summary Tables of Generated Scenarios

Scenario	Pricing Policy	Inventory Policy	Other Scheme
1	Average price of each product group increased by 8 percent per annum	2 months closing inventory	
2	Average price of each product group increased by wholesale price index of Woollen Textile per annum	-do-	
3	Average price of each product group increased by 8 percent per annum	3 months closing inventory	
4	Average price of each product group increased by wholesale price index of Woollen Textile per annum	-do-	
5	Average price of each product group increased by 8 percent per annum	-do-	Investment in modernization spread over 1983-84 to 1987-88 plus increase in adv. and selling commissions.

MARKET SALES  
OF  
Woolen TEXTILE



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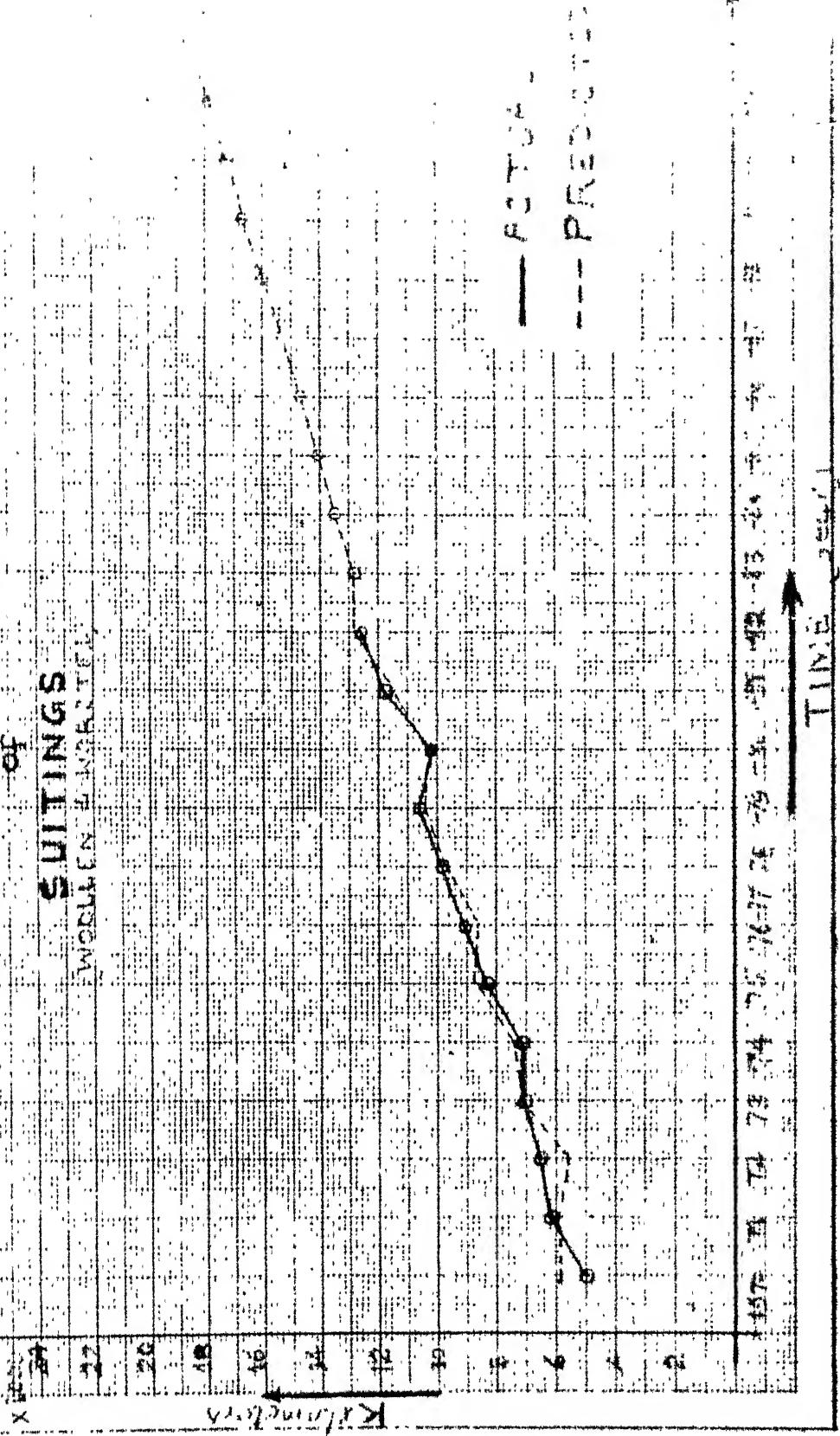
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# MARKET SALES

## OF SUITINGS

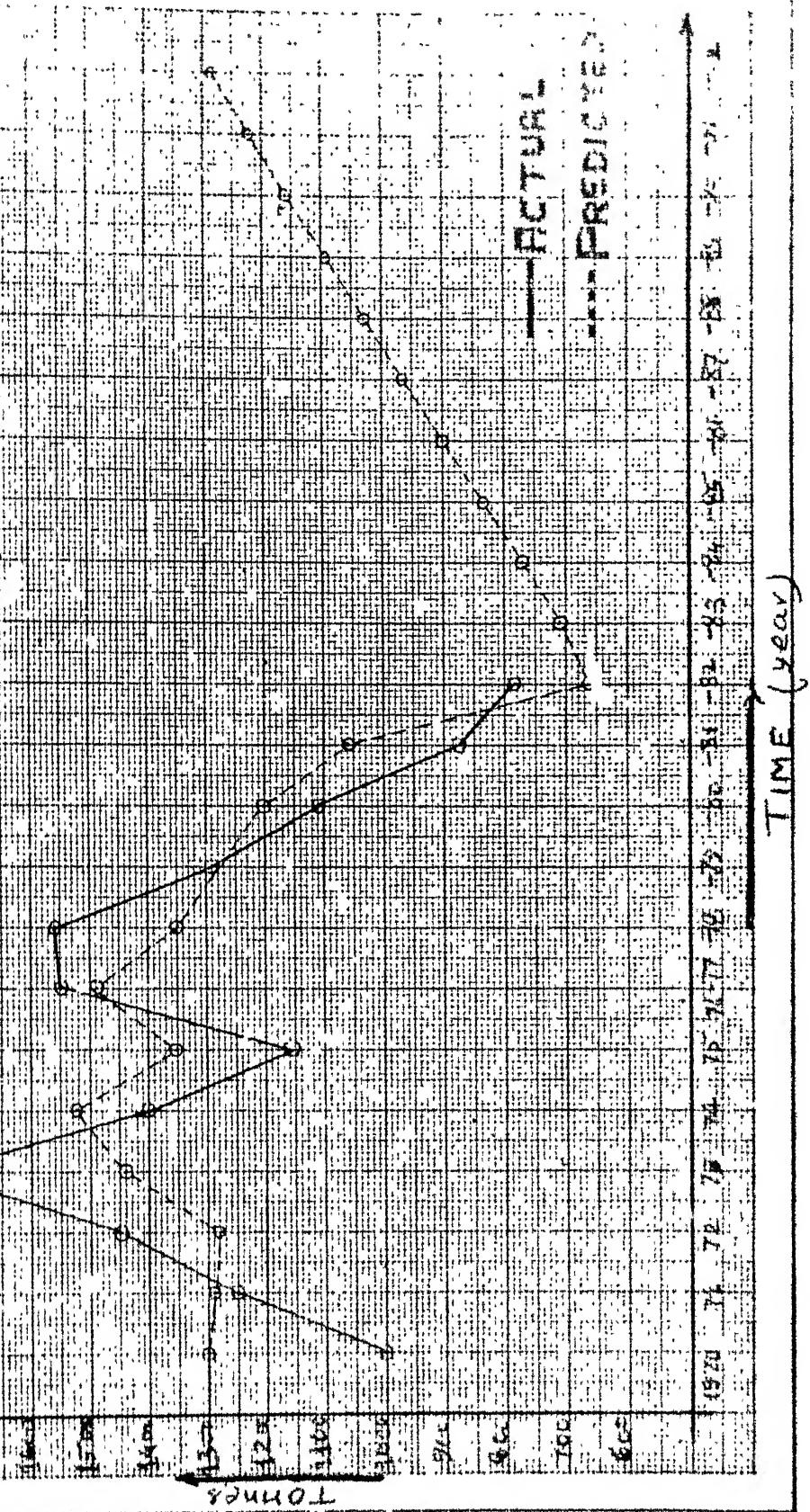
WORLDS LARGEST



# MARKET SHARES

OF

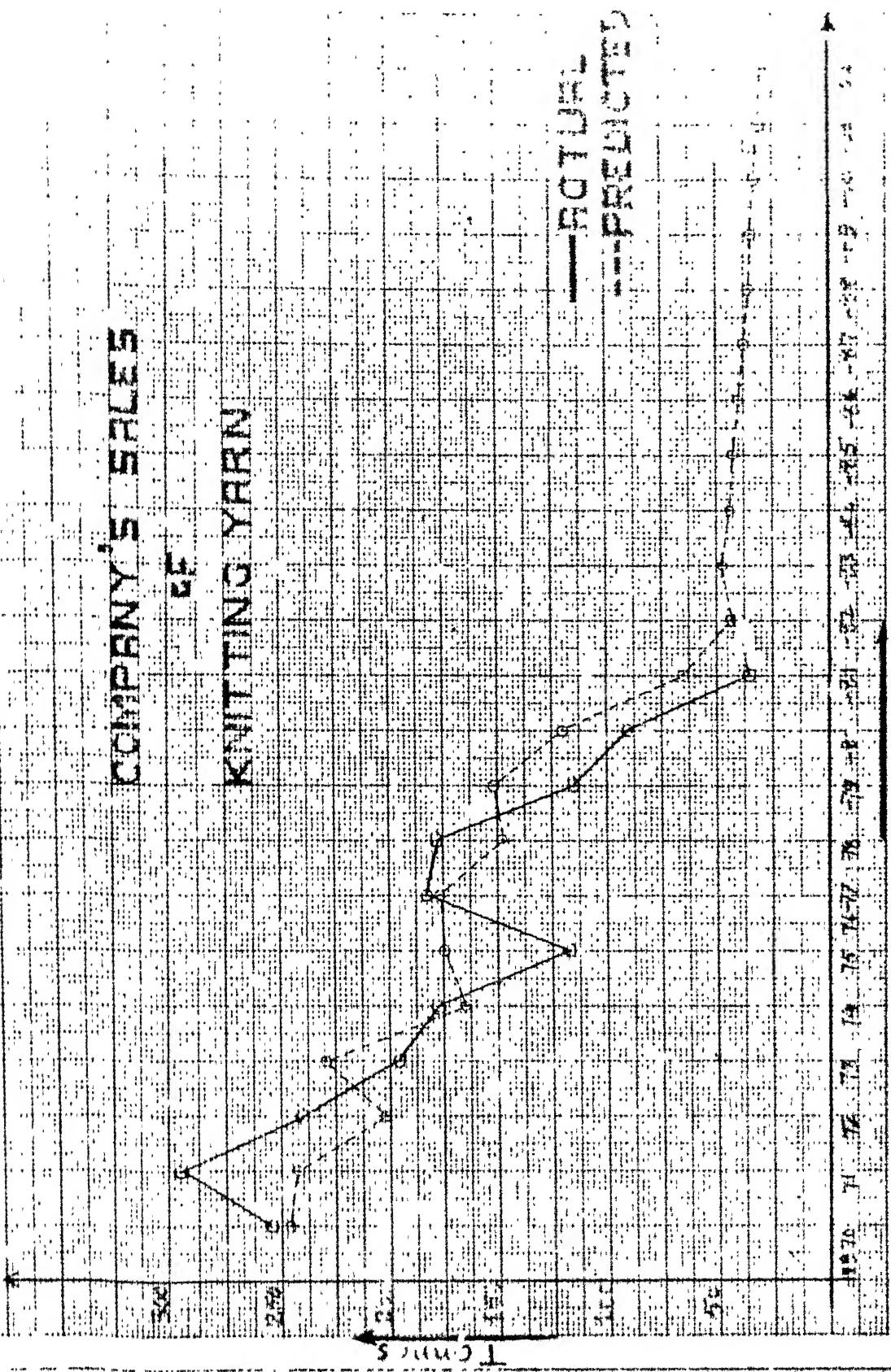
## KNITTING YARN



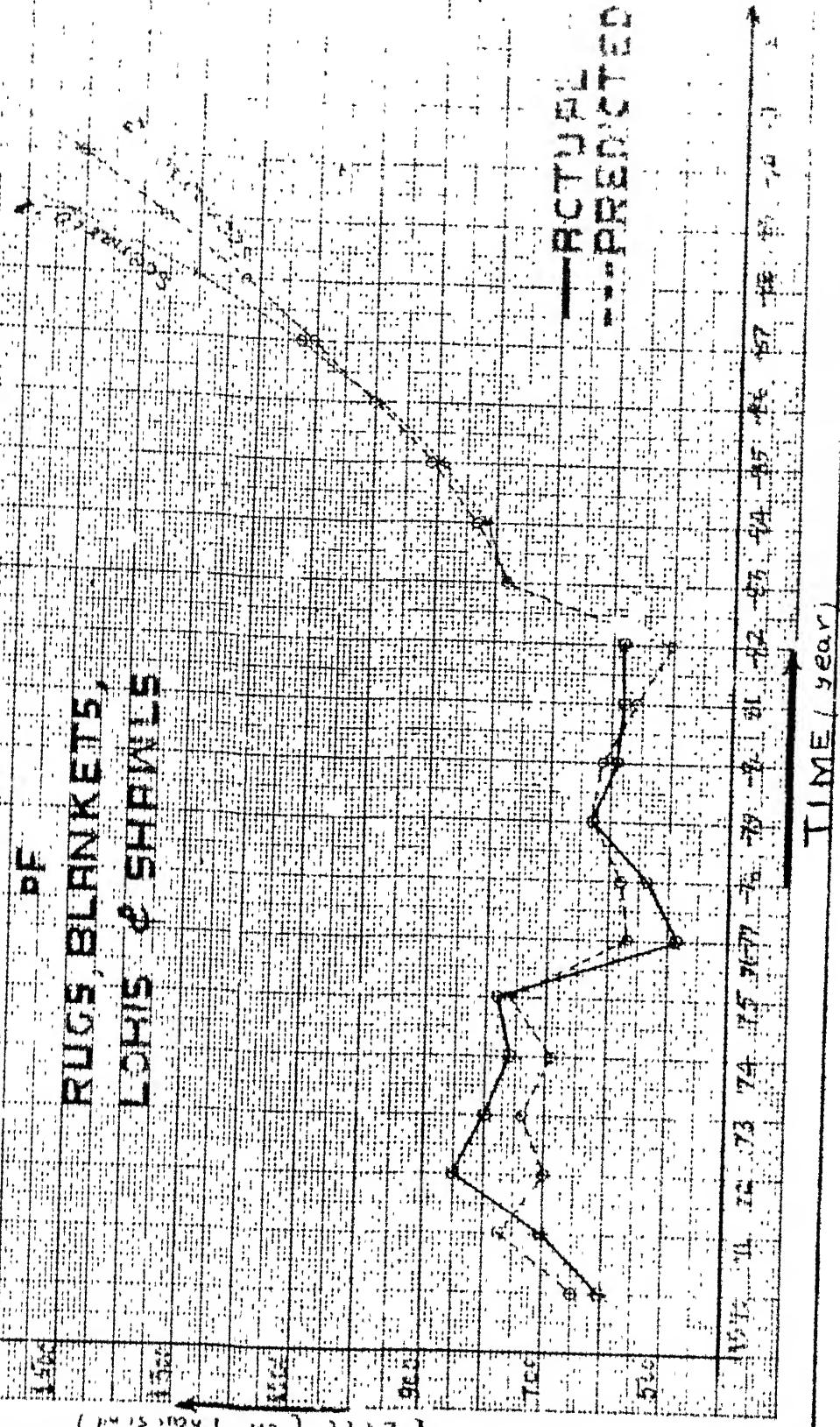
TIME (hour)

## COMPANY, 5 SLEEVES

## CUTTING SPREAD

PREDICTED  
TEST

COMPANY'S EARNINGS  
OF  
RUGS, BLANKETS,  
LODGE & SHEETS



## **SEIGNEUREVENU**

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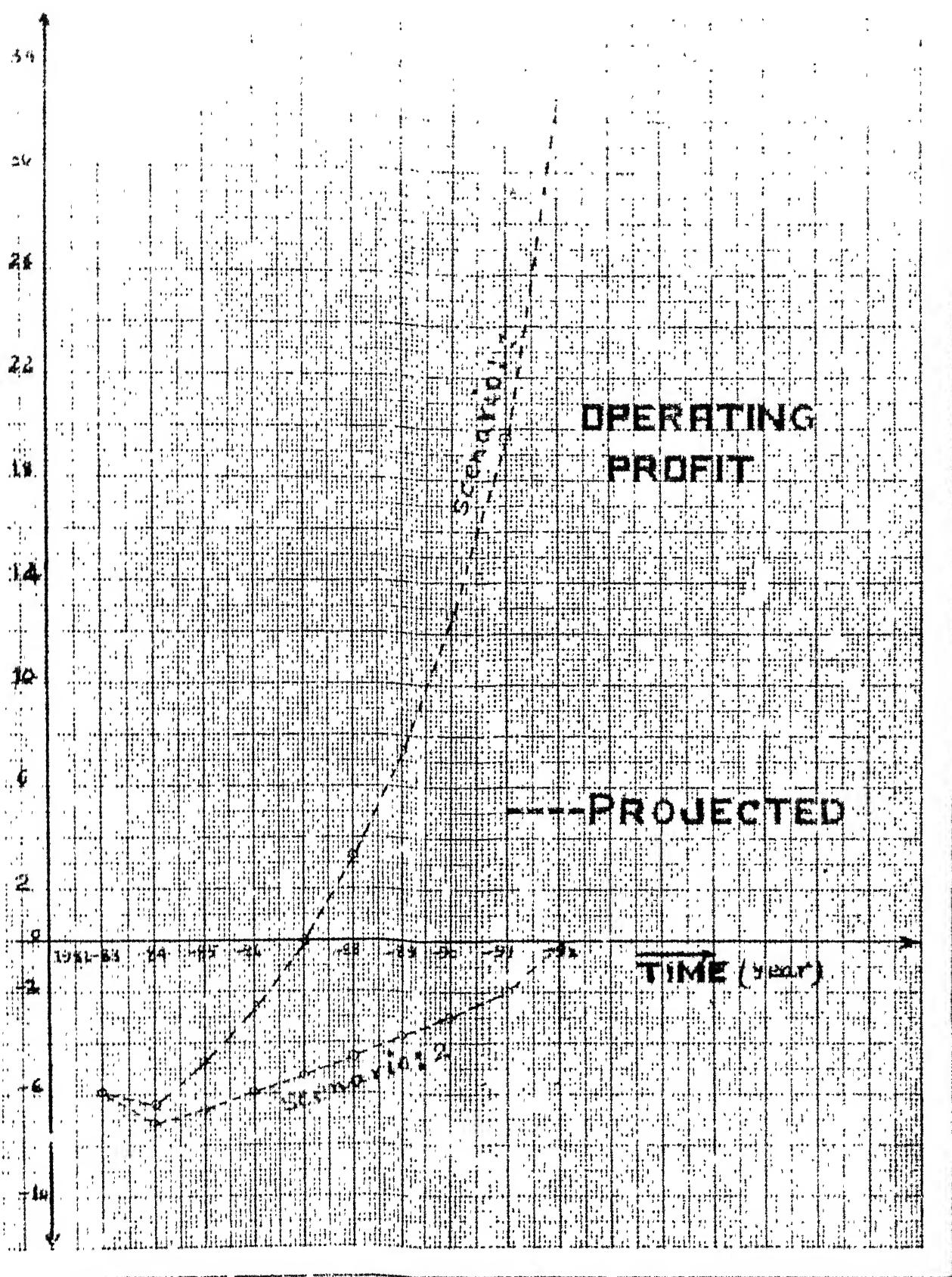
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(S2A042) 5

PROJECTED

### TIME [year]



### 8. What Actions the Company Should Take:

After going through the actions and its implications on financial performance of the company, as presented in Appendix, one can see the considerable effects of the pricing policy. For fast growth of the company, the price increased by 8 - 10 percent each year seems to be quite reasonable. One must note the model does not consider the price effects on the sales of suitings and it does not get any feedback and resistance from market but the assumption regarding the market share of suitings which is the major tool for predicting the sales of suitings has been taken after proper judgement of the company's plan to cover the market.

The changes in the inventory levels has some effect on the interest charges of the order of 20-30 lakhs which may not be crucial for the company's massive capital growth.

Further, the modernisation plan has different implications on the performance. Scenario 5 considers the modernisation effects in the following fashion:

- The company invests about Rs. 250 lakhs each year from the current year 1983-84 for next 5 years.
- The total sales revenue goes up by about 15 percent.
- The realisation starts after 2 years of the investment.
- The market share of suiting goes up from 15 percent to 17 percent in first 3 years of the realisations and 20 percent in rest of the years, due to the

drastic improvement in quality of products and increasing advertising expenses by 1 percent of the sales revenue.

- Then company can fulfil the demand of the sales representatives commission 4 percent instead of 3 percent from 84-85 onwards.

After all these what we feel about the future market, the quality is one of the demanding factor and this can only be achieved through proper modernisation. There are lot of benefits from the modernisation and its impacts on the changes in the demands of the products and overall performance of the company but due to lack of detailed informations we have just incorporated few major changes likely to occur.

#### 8.4 Direct and Indirect Benefits from this Corporate Planning Model:

The purpose of the model is to provide timely and consistent information based on a specific set of assumptions. Management is then able to use this information to establish realistic goals for the company.

Management can apply various strategies over which it has direct control (price, sales force etc.) and project those over which management has only indirect control (sales, market share etc.) and evaluate the financial impacts of the decisions.

Marketing model is designed to estimate the future size of the market and market share which may be obtained by the company.

Production model is designed to determine the cost of production and inventory level to fulfil the estimated level of demand.

Financial model is designed to exhibit the financial impacts of policy assumption of the management.

The primary benefit to be derived from the use of this model is to conduct "what if" experiments i.e. alternative scenarios can be generated in no time reflecting a wide variety of different managerial policies and assumptions about the external environment in which the company will operate.

#### 8.5 Some Limitations:

This corporate planning model does not attempt to predict events which occur discontinuously such as wars, strikes, political events etc.

Lack of substantial interaction between the model builder and management also limits the model's accuracy and credibility.

By its very nature, corporate planning is a highly political process. For this reason it is rather difficult to implement an effective planning and modeling system without addressing squarely the politics of planning.

Complex systems do not contain such clearly defined causal relationships, but contain a multiplicity of interacting negative and positive feedback loops that are often interrelated in a highly nonlinear fashion.

We expect that future efforts in this direction will take care of some of the above limitations.

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## FORTRAN-TV LISTINGS

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*****  

PROGRAM FOR CORPORATE PLANNING  

*****  

READ MSHSU, INTST, NPROBT, MASSET, INVST, ATC, NRVY, NRUST, NRVRD, MCOST  

REAL LEHR, TEY, LTLOAN  

DIMENSTON WPIG(10), WPTW(10), WPTG(10), GNPC(10), PCI(10), CPI(10),  

1 TSU(10), THSU(10), THY(10), CS(10), CRR(10), CY(10), CSUF(10),  

2 PY(12), PRB(11), PSU(11), SEXP(11), ADVT(11), CPRDD(11), CGS(11)  

3 DIMENSTON DINV(11), TNV(11), VCOST(11), MCOST(11),  

4 SATREV(11), GPRDET(11), NPROFEC(11), DPROFET(11), TGREVC(11),  

5 TNTST(11), DEPY(11), DEP(11), INX(11), DTVTDT(11), PE(11), DEU(11),  

6 DIMENSTON GASSET(11), MASSET(11), TNVST(11), NIF(11), ALDAM(11),  

7 TASSET(11), OASSET(11), LTLOAN(11), CHIA(11), TOTAC(11),  

8 CRAIC(11), GPKAT(11), OPRAT(11), RDA(11), REPAI(11),  

9 OASSE(11), TINV(11), OTHINC(11)  

DIMENSTON RINV(11), RTINV(11), MSHSU(10)
*****  

TNTSTALISATION  

*****  

DATA ALDAM/0,0,250,250,250,250,250,0,0,0/  

DATA MSHSU/3*0,15,3*0,17,4*0,2/  

DINV(1)=499.8; SEXP(1)=60.5; ADVT(1)=26.26; DEP(1)=-1515.27  

MASSET(1)=548.25; LTLOAN(1)=1308.0; DEP(1)=536.95; GASSET(1)=830.56  

TNVST(1)=146.7; ECUST=570.0; WAGES=017.0; TAXRAT=0.5  

DEPRAT=0.05; DIVRAT=0.07; VCY=134.13; VCRB=94.79; VCSU=43.9  

NIF(1)=20.0; IR=18.5; IPY=0; TPRB=0.08; TPSU=0.08  

PY(1)=170.0; PRB(1)=96.6; PSU(1)=81.0  

NMF=2; NMR=2.5; NMT=2  

*****  

MODELS FOR ECONOMIC INDICATORS  

*****

```

```

JO=1  

M=10  

DO 5 I=1,M  

TIME=I+12  

WPTG(1)=77.7+15.136*TIME  

WPTW(1)=96.6+13.38*TIME  

WPTS(1)=84.27+11.05*TIME  

GNPC(1)=31239.77+2499.5*TIME+327.68*(TIME**2)  

PCI(1)=596.0+10.2*TIME  

CPI(1)=162.4+22.0*TIME  

CONTINUE  

*****  

MARKETING MODELS  

*****

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19 DO 19 T=1,10  

20 PY(I+1)=(1+IPY)*PY(I); PRB(T+1)=(1+TPRB)*PRB(T); PSU(I+1)=(1+IPSU)*PSU(I)  

21 CONTINUE  

22 DD 21 T=1,10  

23 PIC(T)=1.157*WPTG(T)-26.52  

24 TMS(T)=0.0016237*GNPC(T)-26.2  

25 TSU(T)=38.17*WPTG(T)+20.91*PCI(T)-11115.8  

26 TIV(T)=5.014*WPS(T)+9.69*PY(I)+1161.29  

27 PRB(T)=5.834*SPAP(T)+27.836*ADVT(T)-6.245*PRB(T)+477.53  

28 SUC(T)=INT(T)*MSHSU(I)  

29 CY(I)=465.17*(WPTG(I)/WPTG(I))-1.03*PY(I)-191.87  

30 *****  

31 PREDICTION MODELS  

32 *****  

33 TGRDI=(VCY(T)*VCRB(1)+VCRB+CSC(1)+VCSU)/100.0  

34 VCOST(T)=TGRDI*(WPTG(I)/WPTG(I))  

35 MCOST(T)=ECUST+WAGE*(CPT(T)/CPI(1))  

36 CPRDD(T)=VCOST(T)+MCOST(T)  

37 DINV(I)=CPRDD(I)*NMF/12.0  

38 CGS(T)=CPRDD(I)+SEXP(I)+DINV(I)-CINV(I)  

39 TINV(I+1)=CINV(I)  

40 TINV(I)=CNMF*CPRDD(I)+NMRF*VCOST(T)+NMFT*(VCOST(T)+MCOST(I))/12.0  

41 ****

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FINANCIAL MODELS
*****
SALREV(1)=(CY(T)*PY(T)+CRB(1)*PRB(T)+CGS(1)*PSU(T))/100.0
SEXPC(1)=0.03*SALREV(T)
ADVTC(1)=0.01*SALREV(T)
OTHINC(1)=0.02*SALREV(T)
TSREV(T)=SALREV(T)+OTHINC(T)
GPROFT(1)=TSREV(T)-CGS(1)
IF(L .LT. 4) GO TO 21
SALREV(1)=1.15*SALREV(T)
SEXPC(1)=0.04*SALREV(T)
TSREV(T)=SALREV(T)+OTHINC(T)
GPROFT(1)=TSREV(T)-CGS(1)
CONTINUE
DO 6 J=2,11
NIF(J)=NIF(J-1)
GASSET(J)=GASSET(J-1)+NIF(J)+ALOAN(J)
DEPY(J)=DEPRAT*GASSET(J)
DEP(J)=DEP(J-1)+DEPY(J)
NASSET(J)=GASSET(J)-DEP(J)
INVST(J)=INVST(J-1)
DASSET(J)=DASSET(1)*SALREV(J-1)/SALREV(1)
CASSET(J)=DASSET(J)+TINV(J-1)
TASSET(J)=NASSET(J)+INVST(J)+CASSET(J)
TPC(J-.80. 6) GO TO 41
GO TO 42
IF(OE(J-1) .GT. 1.0) GO TO 43
GO TO 42
REPAY(J)=DE(J-1)
OE(J-1)=OE(J-1)-REPAY(J)
GO TO 46
REPAY(J)=0.0
LTLOAN(J)=LTLOAN(J-1)+ALOAN(J)-REPAY(J)
TNTST(J)=6.237+0.0149*LTLOAN(J)*IR+0.01*TINV(J)*IR
DPROFT(J)=GPROFT(J-1)-TNTST(J)-DEPY(J)
IF(DPROFT(J) .LE. 0.0) GO TO 7
GO TO 8
TAX(J)=0.0; GO TO 9
TAX(J)=TAXRAT*DPROFT(J)
NPROFT(J)=DPROFT(J)-TAX(J)
IF(OE(J-1) .LE. 0.0) GO TO 10
GO TO 11
DIVIDT(J)=0.0; GO TO 12
DIVIDT(J)=DIVRAT*TDF(J-1)
RF(J)=NPROFT(J)-DIVIDT(J)
RF(J)=OE(J-1)+RF(J)
CLTAC(J)=TASSET(J)-LTLOAN(J)-OE(J)
TUTAC(J)=CLTAC(J)+LTLOAN(J)
*****
FINANCIAL RATIOS
*****
RIT(J-1)=TAX(J-1)/TSREV(J-1)
OTINV(J-1)=0.5*(TNTST(J-1)+CTINV(J-1))/TSREV(J-1)
CRAT(J)=CASSET(J)/CLTAC(J)
UPRFT(J-1)=GPROFT(J-1)/SALREV(J-1)
UPRAT(J)=UPRFT(J)/SALREV(J-1)
PDT(J)=DPROFT(J)/TASSET(J)
CONTINUE
*****
REPORT GENERATION
*****
TF(JT .GT. 1) GO TO 17
WRTTE(22,100)
FORMAT(20//35X,'PROJECTED NATIONAL ECONOMIC ANNUAL INDICATORS')
'(1982-1992) //'
WRTTE(22,110)
FORMAT(75X,'*****')
***** WRTTE(22,130)

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120 1 WRTIE(22,120)  
 ,FORMAT(4IX, '82-83 83-84 84-85 85-86 86-87 87-88',  
 ,88-89 89-90 90-91 91-92 )  
 130 1 WRTIE(22,130)  
 ,FORMAT(5X, -----,  
 ,-----)  
 140 1 WRTIE(22,140)  
 ,FORMAT(5X, 'WHOLESALE PRTCE INDEX (1970-71=100)',  
 ,WRTIE(22,150) (WPIC(I), I=1,10)  
 ,FORMAT(10X, 'GENERAL COMMODITIES ', 8X,10(F8.1))  
 ,WRTIE(22,140)  
 ,WRTIE(22,160) (WPIC(I), I=1,10)  
 ,FORMAT(10X, 'WOOLLEN TEXTILE & YARN', 6X,10(F8.1))  
 ,WRTIE(22,140)  
 ,WRTIE(22,170) (WPIS(I), I=1,10)  
 ,FORMAT(10X, 'SYNTHETIC FABRICS', 11X,10(F8.1))  
 ,WRTIE(22,180) (GNPC(I), I=1,10)  
 ,FORMAT(5X, 'GNP AT CURRENT MARKET PRICES', 5X,10(F8.0))  
 ,WRTIE(22,200) (PC1(I), I=1,10)  
 ,FORMAT(5X, 'PER CAPITA INCOME AT 1970-71', 5X,10(F8.1))  
 ,WRTIE(22,210) (CPI(I), I=1,10)  
 ,FORMAT(5X, 'CONSUMER PRICE INDEX (1960=100)', 2X,10(F8.1))  
 ,WRTIE(22,130)  
 \*\*\*\*\*  
 CCC MARKETING MODELS REPORTS  
 \*\*\*\*\*  
 17 1 WRTIE(22,230) ,IJ  
 230 1 FORMAT(20(/)35X, 'DEMAND FORECASTING FOR TOTAL MARKET AND',  
 , ' COMPANY (1982-1992)', 5X, 'SCENARIO : ', J2)  
 ,WRTIE(22,140)  
 ,WRTIE(22,130)  
 ,WRTIE(22,120)  
 ,WRTIE(22,130)  
 ,WRTIE(22,240) (TMSC(I), I=1,10)  
 240 1 FORMAT(5X, 'TOTAL MARKET SALES OF WOOLLEN', 15X, '(RS. 'CRORES)',  
 , 11X,10(F8.1))  
 ,WRTIE(22,250) (TMSH(I), I=1,10)  
 250 1 FORMAT(5X, 'TOTAL MARKET SUITINGS(KMTRS)', 10X,  
 , 'WOOLLEN AND WORSTED', 8X,10(F8.1))  
 ,WRTIE(22,260) (TMY(I), I=1,10)  
 ,FORMAT(5X, 'TOTAL MARKET KNITTING YARN(TONNES)', 10(F8.1))  
 ,WRTIE(22,270) (CY(I), I=1,10)  
 ,FORMAT(5X, 'COMPANY'S KNITTING YARN(TONNES)', 3X,10(F8.1))  
 ,WRTIE(22,275) (PYC(I), I=1,10)  
 ,FORMAT(5X, 'PRICE OF KNITTING YARN (RS./KG)', 2X,10(F8.1))  
 ,WRTIE(22,280) (CRB(I), I=1,10)  
 ,FORMAT(5X, 'COMPANY'S RUGS & BLANKETS(PCS)', 4X,10(F8.1))  
 ,WRTIE(22,285) (PRB(I), I=1,10)  
 ,FORMAT(5X, 'PRICE OF RUGS & BLANKETS (RS./PC)', 10(F8.1))  
 ,WRTIE(22,290) (CSU(I), I=1,10)  
 ,FORMAT(5X, 'COMPANY'S SUITINGS(KMTRS)', 9X,10(F8.1))  
 ,WRTIE(22,295) (PSU(I), I=1,10)  
 ,FORMAT(5X, 'PRICE OF SUITINGS (RS./MTRS)', 5X,10(F8.1))  
 ,WRTIE(22,130)  
 \*\*\*\*\*  
 CCC PRODUCTION MODELS REPORTS  
 \*\*\*\*\*  
 310 1 WRTIE(22,310) ,IJ  
 ,FORMAT(141/20(/)35X, 'PROJECTED PRODUCTION PLANNING FOR COMPANY',  
 , '(1982-1992)', 5X, 'SCENARIO : ', J2)  
 ,WRTIE(22,110)  
 ,WRTIE(22,130)  
 ,WRTIE(22,120)  
 ,WRTIE(22,130)  
 ,WRTIE(22,320) (VCOST(I), I=1,10)  
 320 1 FORMAT(5X, 'A) TOTAL VARIABLE COSTS', 10X,10(F8.1))  
 ,WRTIE(22,330) (MCOST(I), I=1,10)  
 ,FORMAT(5X, 'B) OTHER MFG. COSTS', 14X,10(F8.1))  
 ,WRTIE(22,340) (CPROD(I), I=1,10)

340 FORMAT(7X,'I) COST OF PRODUCTION (A+B)\*,3X,10(F8.1))  
 WRITE(22,350) (SEXPI(I),I=1,10)  
 FORMAT(7X,'T1) SELLING EXPENSES',11X,10(F8.1))  
 WRITE(22,360) (CINV(I),I=1,10)  
 FORMAT(7X,'C) OPENING INVENTORY',10X,10(F8.1))  
 WRITE(22,370) (CTNY(I),I=1,10)  
 FORMAT(7X,'D) CLOSING INVENTORY',10X,10(F8.1))  
 WRITE(22,380) (CGS(I),I=1,10)  
 FORMAT(7X,'COST OF GOODS SOLD (A+I+C-D)\*,1X,10(F8.1))  
 WRITE(22,130)  
 \*\*\*\*  
 FINANCIAL MODELS REPORTS  
 \*\*\*\*  
 WRITE(22,390) JJ  
 390 FORMAT(1H1,20(/)35X,'PROJECTED INCOME STATEMENTS (1982-1992)',8X,  
 'SCENARIO : ',12,10X,'(RS. LAKHS)')  
 WRITE(22,110)  
 WRITE(22,130)  
 WRITE(22,120)  
 WRITE(22,130)  
 WRITE(22,410) ('SALEREV(I),I=1,10)  
 410 FORMAT(7X,'SALES REVENUE',20X,10(F8.1))  
 WRITE(22,420) ('OTHINCC(I),I=1,10)  
 420 FORMAT(7X,'OTHER INCOME',21X,10(F8.1))  
 WRITE(22,430) ('TSREV(I),I=1,10)  
 430 FORMAT(7X,'TOTAL SALES REVENUE',12X,10(F8.1))  
 WRITE(22,440) ('CGS(I),I=1,10)  
 440 FORMAT(7X,'LESS: COST OF GOODS SOLD',8X,10(F8.1))  
 WRITE(22,450) ('GPROFT(I),I=1,10)  
 450 FORMAT(7X,'GROSS PROFIT',16X,10(F8.1))  
 WRITE(22,460) ('INTST(I),I=2,11)  
 460 FORMAT(7X,'INTEREST',18X,10(F8.1))  
 WRITE(22,470) ('OPROFT(I),I=2,11)  
 470 FORMAT(7X,'OPERATING PROFIT',12X,10(F8.1))  
 WRITE(22,480) ('TAX(I),I=2,11)  
 480 FORMAT(7X,'PROVISION FOR TAXES',7X,10(F8.1))  
 WRITE(22,490) ('NPROFT(I),I=2,11)  
 490 FORMAT(7X,'NET PROFIT',18X,10(F8.1))  
 WRITE(22,500) ('DIVRAT',('DIVIDT(I),I=2,11))  
 500 FORMAT(712X,'DIVIDENDS AT @ ',F3.2,8X,10(F8.1))  
 WRITE(22,510) ('RE(I),I=2,11)  
 510 FORMAT(7X,'RETAINED EARNINGS',11X,10(F8.1))  
 WRITE(22,130)  
 WRITE(22,520) JJ  
 520 FORMAT(1H1/12(/)35X,'PROTECTED BALANCE SHEET (1982-1992)',8X,  
 'SCENARIO : ',12,10X,'(RS. LAKHS)')  
 WRITE(22,110)  
 WRITE(22,130)  
 WRITE(22,120)  
 WRITE(22,130)  
 WRITE(22,530) ('ASSET(I),I=2,11)  
 530 FORMAT(7X,'FIXED ASSETS(NET)',12X,10(F8.1))  
 WRITE(22,540) ('CASSET(I),I=2,11)  
 540 FORMAT(7X,'GROSS ASSETS',12X,10(F8.1))  
 WRITE(22,550) ('DEP(I),I=2,11)  
 550 FORMAT(7X,'LESS:DEPRECIATION',7X,10(F8.1))  
 WRITE(22,560) ('CASSET(I),I=2,11)  
 560 FORMAT(7X,'CURRENT ASSETS',16X,10(F8.1))  
 WRITE(22,560) ('TTINV(I),I=1,10)  
 560 FORMAT(7X,'INVENTORIES',14X,10(F8.1))  
 WRITE(22,570) ('CASSET(I),I=2,11)  
 570 FORMAT(7X,'OTHER CURRENT ASSETS',5X,10(F8.1))  
 WRITE(22,590) ('INVST(I),I=2,11)  
 590 FORMAT(7X,'INVESTMENTS',19X,10(F8.1))  
 WRITE(22,600) ('TASSET(I),I=2,11)  
 600 FORMAT(7X,'TOTAL ASSETS',21X,10(F8.1))  
 WRITE(22,630) ('TLIA(I),I=2,11)  
 630 FORMAT(7X,'TOTAL LIABILITIES',16X,10(F8.1))  
 WRITE(22,610) ('LTLOAN(I),I=2,11)  
 610 FORMAT(7X,'LONG TERM LIABILITIES',9X,10(F8.1))

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620 WRTIE(22,620) '(CLIACT),I=2,11)
FORMAT(/8X,'CURRENT LIABILITIES',11X,10(F8.1))
640 WRTIE(22,640) '(OE(T),I=2,11)
FORMAT(/5X,'OWNERS EQUITY',20X,10(F8.1))
WRTIE(22,130)
WRTIE(22,660) JJ
660 1 FORMAT(/35X,'PROJECTED FINANCIAL RATIOS (1982-1992)',8X,
'SCENARIO : ',T2)
WRTIE(22,110)
WRTIE(22,130)
WRTIE(22,120)
WRTIE(22,130)
WRTIE(22,680) '(CRAT(T),I=2,11)
680 FORMAT(/8X,'CURRENT RATIO',17X,10(F8.2))
WRTIE(22,690) '(GPRAT(I),I=1,10)
690 FORMAT(/8X,'GROSS PROFIT RATIO',12X,10(F8.2))
WRTIE(22,700) '(OPRAT(I),I=2,11)
700 FORMAT(/8X,'OPERATING PROFIT RATIO',8X,10(F8.2))
WRTIE(22,710) '(ROAC(I),I=2,11)
710 FORMAT(/8X,'RETURN ON ASSETS',14X,10(F8.2))
WRTIE(22,760) '(RTINV(I),I=1,10)
760 FORMAT(/8X,'TOTAL INVENTORY TO SALES RATIO',10(F8.2))
WRTIE(22,770) '(RTNV(T),I=1,10)
770 FORMAT(/8X,'FINISH INV. TO SALES RATIO',4X,10(F8.2))
WRTIE(22,130)
TJ=JJ+1
IF(JJ.LT. 3) GO TO 27
27 GO TO 28
DO 1 I=1,10
RI=WPIW(T)/WPIW(1)
PRB(T)=PRB(1)*RI
PSU(T)=PSU(1)*RI
PYC(T)=PYC(1)
CONTINUE
1 IF(JJ.LT. 3) GO TO 16
NMF=3
IF(JJ.LT. 4) GO TO 19
GO TO 27
IF(JJ.LT. 6) GO TO 16
STOP
END
*****
```

PROJECTED NATIONAL ECONOMIC ANNUAL INDICATORS (1982-1992)

	82-83	83-84	84-85	85-86	86-87	87-88	88-89	89-90	90-91	91-92
WHOLESALE PRICE INDEX (1970-71=100) GENERAL COMMODITIES	274.5	289.6	304.7	319.9	335.0	350.1	365.3	380.4	395.6	410.7
WHOLESALE PRICE INDEX (1970-71=100) WOOLLEN TEXTILE & YARN	270.5	283.9	297.3	310.7	324.1	337.4	350.8	364.2	377.6	391.0
WHOLESALE PRICE INDEX (1970-71=100) SYNTHETIC FABRICS	227.9	239.0	250.0	261.1	272.1	283.2	294.2	305.3	316.3	327.4
GNP AT CURRENT MARKET PRICES	119111.	130458.	142460.	155118.	168431.	182399.	197023.	212302.	228236.	244826.
PER CAPITA INCOME AT 1970-71	728.6	738.8	749.0	759.2	769.4	779.6	789.8	800.0	810.2	820.4
CONSUMER PRICE INDEX (1960=100)	448.4	470.4	492.4	514.4	536.4	558.4	580.4	602.4	624.4	646.4

PROJECTED PRODUCTION PLANNING FOR COMPANY (1982-1992) SCENARO : 1

\* \* \* \* \*

	82-83	83-84	84-85	85-86	86-87	87-88	88-89	89-90	90-91	91-92
A) TOTAL VARIABLE COSTS	1645.1	1802.8	2008.5	2257.7	2555.5	2913.2	3347.9	3985.1	4561.5	5432.1
B) OTHER MFG. COSTS	1187.0	1217.3	1247.5	1277.8	1308.1	1338.4	1368.6	1398.9	1429.2	1459.4
I) COST OF PRODUCTION (A+B)	2832.1	3020.1	3256.1	3535.6	3863.6	4251.5	4716.5	5284.0	5990.7	6891.5
II) SELLING EXPENSES	60.5	77.4	87.2	99.5	114.4	132.5	154.4	181.3	214.8	257.3
C) OPENING INVENTORY	499.8	472.0	503.3	542.7	589.3	643.9	708.6	786.1	880.7	998.4
D) CLOSING INVENTORY	472.0	503.3	542.7	589.3	643.9	708.6	786.1	880.7	998.4	1148.6
COST OF GOODS SOLD (I+II+C-D)	2920.4	3066.1	3303.9	3588.5	3923.4	4319.3	4793.4	5370.7	6087.7	6998.6

## PROJECTED INCOME STATEMENTS (1982-1992)

SCENARIO : 1

(RS. LAKHS)

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## PROJECTED BALANCE SHEET (1982-1992)

SCENARIO : 1

(RS. LAKHS)

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	82-83	83-84	84-85	85-86	86-87	87-88	88-89	89-90	90-91	91-92
FIXED ASSETS(NET)	271.1	247.6	223.0	197.5	171.0	143.4	114.9	85.4	54.9	23.3
GROSS ASSETS	850.6	870.6	890.6	910.6	930.6	950.6	970.6	990.6	1010.6	1030.6
LESS:DEPRECIATION	579.5	623.0	667.5	713.1	759.6	807.1	855.6	905.2	955.7	1007.2
CURRENT ASSETS	1736.1	1898.3	2104.4	2352.8	2649.4	3005.7	3439.2	3975.0	4650.1	5519.4
INVENTORIES	1187.9	1280.8	1399.8	1542.4	1711.3	1912.5	2155.6	2454.1	2828.1	3307.2
OTHER CURRENT ASSETS	548.3	617.4	704.6	810.4	938.1	1093.2	1283.6	1520.9	1822.0	2212.2
INVESTMENTS	146.7	146.7	146.7	146.7	146.7	146.7	146.7	146.7	146.7	146.7
TOTAL ASSETS	2153.9	2292.5	2474.2	2697.0	2967.0	3295.9	3700.8	4207.1	4851.6	5689.4
TOTAL LIABILITIES	4472.2	5239.2	5882.3	6359.4	6627.0	6790.6	6824.2	6695.4	6362.7	5593.8
LONG TERM LIABILITIES	1308.0	1308.0	1308.0	1308.0	1308.0	1308.0	1308.0	1308.0	1308.0	1308.0
CURRENT LIABILITIES	3164.2	3931.2	4574.3	5051.4	5319.0	5482.6	5516.2	5387.4	5054.7	4285.8
OWNERS EQUITY	-2318.3	-2946.7	-3408.1	-3662.4	-3660.0	-3494.7	-3123.4	-2489.3	-1511.1	95.6

## PROJECTED FINANCIAL RATIOS (1982-1992)

SCENARIO : 1

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	82-83	83-84	84-85	85-86	86-87	87-88	88-89	89-90	90-91	91-92
CURRENT RATIO	0.55	0.48	0.46	0.47	0.50	0.55	0.62	0.74	0.92	1.29
GROSS PROFIT RATIO	-0.11	-0.04	0.02	0.08	0.13	0.18	0.23	0.27	0.31	0.35
OPERATING PROFIT RATIO	-0.31	-0.22	-0.14	-0.07	0.00	0.06	0.12	0.19	0.23	0.31
RETURN ON ASSETS	-0.37	-0.27	-0.19	-0.09	0.00	0.05	0.10	0.15	0.20	0.23
TOTAL INVENTORY TO SALES RATIO	0.45	0.43	0.41	0.40	0.38	0.36	0.35	0.34	0.32	0.31
FINISH INV. TO SALES RATIO	0.18	0.16	0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.10

DEMAND FORECASTING FOR TOTAL MARKET AND COMPANY (1982-1992) SCENARIO : 2

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	82-83	83-84	84-85	85-86	86-87	87-88	88-89	89-90	90-91	91-92
TOTAL MARKET SALES OF WOOLLEN (RS. CRORES)	167.2	185.6	205.1	225.7	247.3	270.0	293.7	318.5	344.4	371.3
TOTAL MARKET SUITINGS(KMTRS) (WOOLLEN AND WORSTED)	12818.9	13454.0	14089.1	14724.1	15359.2	15994.2	16629.3	17264.4	17899.4	18534.5
TOTAL MARKET KNITTING YARN(TONNE)	707.3	771.6	835.8	900.1	964.3	1028.5	1092.8	1157.0	1221.3	1285.5
COMPANYS KNITTING YARN(TONNES)	46.9	44.4	42.1	40.0	38.1	36.4	34.8	33.3	32.0	30.8
PRICE OF KNITTING YARN (RS./KG)	183.6	183.6	183.6	183.6	183.6	183.6	183.6	183.6	183.6	183.6
COMPANYS RUGS & BLANKETS(PCS)	778.6	834.7	910.4	1001.1	1105.5	1224.2	1358.2	1508.8	1677.9	1867.5
PRICE OF RUGS & BLANKETS (RS./PC)	104.3	109.5	114.6	119.8	125.0	130.1	135.3	140.4	145.6	150.8
COMPANYS SUITINGS(KMTRS)	1922.8	2018.1	2113.4	2208.6	2303.9	2399.1	2494.4	2589.7	2684.9	2780.2
PRICE OF SUITINGS (RS./MTRS)	87.5	91.8	96.1	100.5	104.8	109.1	113.4	117.8	122.1	126.4

## PROJECTED PRODUCTION PLANNING FOR COMPANY (1982-1992) SCENARIO : 2

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	82-83	83-84	84-85	85-86	86-87	87-88	88-89	89-90	90-91	91-92
A) TOTAL VARTABLE COSTS	1645.1	1822.6	2029.9	2264.7	2528.0	2821.9	3149.9	3516.0	3924.7	4381.5
B) OTHER MFG. COSTS	1187.0	1217.3	1247.5	1277.8	1308.1	1338.4	1368.6	1398.9	1429.2	1459.4
I) COST OF PRODUCTION (A+B)	2832.1	3039.9	3277.5	3542.6	3836.0	4160.3	4518.6	4914.9	5353.9	5841.0
II) SELLING EXPENSES	60.5	77.4	85.4	94.6	104.7	116.0	128.3	141.9	156.9	173.4
C) OPENING INVENTORY	499.8	472.0	506.6	546.2	590.4	639.3	693.4	753.1	819.1	892.3
D) CLOSING INVENTORY	472.0	506.6	546.2	590.4	639.3	693.4	753.1	819.1	892.3	973.5
COST OF GOODS SOLD (I+II+C-D)	2920.4	3082.6	3323.3	3593.0	3891.9	4222.2	4587.2	4990.8	5437.6	5933.2

## PROJECTED BALANCE SHEET (1982-1992)

SCENARIO # 2

CFS. UNADJ.

	82-83	83-84	84-85	85-86	86-87	87-88	88-89	89-90	90-91	91-92
FIXED ASSETS(CAP)	271.1	247.6	223.0	197.5	171.0	143.4	114.9	85.4	54.9	23.3
GROSS ASSETS	850.6	870.6	890.6	910.6	930.6	950.6	970.6	990.6	1010.6	1030.6
LESS:DEPRECIATION	570.5	623.0	667.5	713.1	759.6	807.1	855.6	905.2	955.7	1007.2
CURRENT ASSETS	1736.1	1896.6	2081.2	2283.0	2517.6	2711.9	3053.5	3355.3	3711.1	4095.1
INVENTORIES	1167.9	1291.5	1411.4	1546.2	1696.3	1853.1	2048.4	2254.2	2463.2	2738.2
OTHER CURRENT ASSETS	548.3	605.1	669.8	741.8	821.3	909.8	1005.1	1111.1	1228.0	1356.1
INVESTMENTS	146.7	146.7	146.7	146.7	146.7	146.7	146.7	146.7	146.7	146.7
TOTAL ASSETS	2153.9	2290.9	2450.9	2632.2	2835.3	3052.1	3315.1	3597.1	3912.7	4265.1
TOTAL LIABILITIES	9473.2	6315.4	6123.7	5891.8	7515.0	8269.8	912.9	9481.5	9792.8	10259.9
LONG TERM LIABILITIES	1308.0	1308.0	1308.0	1308.0	1308.0	1308.0	1308.0	1308.0	1308.0	1308.0
CURRENT LIABILITIES	3165.2	4007.4	4815.7	5583.8	6307.0	6981.8	7634.0	8173.5	8684.9	9050.9
OWNERS EQUITY	-2319.3	-3024.5	-3672.8	-4259.6	-4779.8	-5227.8	-5597.9	-5881.1	-6060.2	-6993.9

## PROJECTED FINANCIAL RATIOS (1982-1992)

SCENARIO # 2

	82-83	83-84	84-85	85-86	86-87	87-88	88-89	89-90	90-91	91-92
CURRENT RATIO	0.55	0.47	0.43	0.31	0.40	0.40	0.40	0.41	0.43	0.46
GROSS PROFIT RATIO	-0.11	-0.06	-0.03	-0.01	0.01	0.03	0.05	0.07	0.08	0.09
OPERATING PROFIT RATIO	-0.31	-0.25	-0.21	-0.17	-0.13	-0.10	-0.08	-0.05	-0.03	0.03
RETURN ON ASSETS	-0.37	-0.31	-0.26	-0.22	-0.18	-0.15	-0.11	-0.08	-0.05	0.02
TOTAL INVENTORY TO SALES RATIO	0.45	0.44	0.44	0.43	0.43	0.43	0.42	0.42	0.42	0.42
FTNTSH INV. TO SALES RATIO	0.18	0.17	0.16	0.16	0.16	0.15	0.15	0.15	0.15	0.14

PROJECTED PRODUCTION PLANNING FOR SUMMARY (1982-1982)      SCENARIO : 3

	82-83	83-84	84-85	85-86	86-87	87-88	88-89	89-90	90-91	91-92
A) TOTAL MATERIEL COSTS	1645.1	1802.8	2038.5	2257.7	2555.5	2013.2	3347.9	3835.1	4561.5	5452.1
B) OTHER MFG. COSTS	1187.0	1217.3	1247.5	1277.8	1308.1	1338.4	1368.6	1399.9	1429.2	1459.1
C) COST OF PRODUCTION (A+B)	2832.1	3020.1	3256.1	3535.6	3903.6	4251.5	4716.5	5284.0	5990.7	6831.5
D) SELLING EXPENSES	60.5	77.4	87.2	99.5	114.4	132.5	154.4	181.3	214.8	257.3
E) OPERATING INVENTORY	499.2	709.0	755.0	814.0	983.9	965.9	1062.9	1179.1	1321.0	1497.7
F) CLOSING INVENTORY	708.0	755.0	814.0	883.9	965.9	1062.9	1179.1	1321.0	1497.7	1722.9
G) COST OF GOODS SOLD (C+D+E+F)	2684.4	3050.5	3264.2	3565.2	3946.0	4287.0	4754.7	5323.4	6029.8	6923.6

## PROJECTED INCOME STATEMENTS (1982-1992)

SCENARIO 3

CRS. DRAFT

	82-83	83-84	84-85	85-86	86-87	87-88	88-89	89-90	90-91	91-92
SALES REVENUE	2580.6	2906.2	3316.5	3914.5	4415.6	5145.5	6041.8	7158.7	8575.8	10412.1
OTHER INCOME	-51.6	-58.1	-66.3	-75.3	-88.3	-102.9	-120.8	-143.2	-171.5	-208.2
TOTAL SALES REVENUE	2632.2	2964.3	3382.9	3997.9	4503.9	5248.4	6162.6	7301.9	8747.3	10620.6
LESS COST OF Goods Sold	-2684.4	-3050.5	-3264.2	-3555.2	-3995.0	-4267.0	-4754.7	-5323.4	-6028.8	-6923.8
GROSS PROFIT	-52.2	-86.1	-98.6	-125.6	-107.9	-96.4	-140.0	-197.5	-271.5	-3697.1
INTEREST	495.0	507.1	522.4	540.0	561.1	586.4	617.5	656.5	706.4	857.0
OPERATING PROFIT	-589.7	-637.1	-468.3	-260.0	0.3	327.1	741.9	1272.5	1961.6	3239.5
PROVISION FOR TAXES	0.0	0.0	0.0	0.0	0.1	163.7	370.9	636.2	980.8	1644.2
NET PROFIT	-589.7	-637.1	-468.3	-260.0	0.1	163.7	370.9	636.2	980.8	1644.2
RETAINED EARNINGS AT 8.0%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RETAINED EARNINGS	-589.7	-637.1	-468.3	-260.0	0.1	163.7	370.9	636.2	980.8	1644.2

## PROJECTED BALANCE SHEET (1982-1992)

SCENARIO 1-3

CFS. (MM\$)

	82-83	83-84	84-85	85-86	86-87	87-88	88-89	89-90	90-91	91-92
FIXED ASSETS (F&E)	271.1	247.5	223.0	197.5	171.0	143.4	114.9	85.4	54.9	23.3
GROSS ASSETS	850.6	870.6	900.6	910.6	930.6	950.6	970.6	990.6	1010.6	1030.6
DEPRECIATION	570.5	623.0	667.5	713.1	759.6	807.1	855.6	905.2	955.7	1007.2
CURRENT ASSETS	1972.1	2149.9	2375.8	2647.4	2971.3	3200.0	3332.3	3415.1	3549.3	3693.7
INVENTORIES	1423.9	1532.5	1671.2	1837.0	2033.2	2266.8	2549.7	2844.5	3227.3	3841.8
OTHER CURRENT ASSETS	548.3	617.4	704.6	810.4	938.1	1093.2	1263.6	1520.9	1822.0	2212.9
INVESTMENTS	146.7	146.7	146.7	146.7	146.7	146.7	146.7	146.7	146.7	146.7
TOTAL ASSETS	2389.9	2544.2	2745.5	2991.6	3289.0	3650.2	3993.9	4647.5	5350.9	6263.7
TOTAL LIABILITIES	4494.9	5286.3	5956.9	6162.0	6769.2	6956.6	7029.4	6946.8	6569.4	5939.0
LONG TERM LIABILITIES	1308.0	1308.0	1308.0	1308.0	1308.0	1308.0	1308.0	1308.0	1308.0	1308.0
CURRENT LIABILITIES	3186.9	3979.3	4647.9	5154.0	5451.2	5648.6	5721.4	5638.8	5361.4	4630.9
OWNERS EQUITY	-2105.0	-2742.1	-3210.4	-3470.3	-3470.2	-3206.5	-2935.5	-2299.3	-1318.5	-325.7

## PROJECTED FINANCIAL RATINGS (1982-1992)

SCENARIO 1-3

	82-83	83-84	84-85	85-86	86-87	87-88	88-89	89-90	90-91	91-92
CURRENT RATIO	0.62	0.54	0.51	0.51	0.55	0.59	0.67	0.78	0.95	1.32
GROSS PROFIT RATIO	-0.02	-0.03	0.03	0.09	0.14	0.19	0.23	0.29	0.32	0.36
OPERATING PROFIT RATIO	-0.23	-0.22	-0.14	-0.07	0.00	0.06	0.12	0.18	0.23	0.32
RETURN ON ASSETS	-0.25	-0.25	-0.17	-0.09	0.00	0.04	0.09	0.14	0.18	0.26
TOTAL INVENTORY TO SALES RATIO	0.54	0.52	0.49	0.47	0.45	0.43	0.41	0.40	0.38	0.37
FINISH INV. TO SALES RATIO	0.23	0.25	0.23	0.22	0.21	0.19	0.18	0.17	0.16	0.15

## PROJECTED PRODUCTION &amp; INVENTORY FOR COMPANY 1982-1992

SCHEDULE 4

	92-83	93-84	94-85	95-86	96-87	97-88	98-89	99-90	00-91	01-92
A) TOTAL VARIABLE COSTS	1615.1	1842.6	2029.9	2261.7	2529.0	2821.9	3149.9	3516.0	3921.7	4361.5
B) OTHER MFG. COSTS	1167.0	1217.3	1247.5	1277.8	1308.1	1339.4	1368.6	1399.9	1420.2	1450.1
C) COST OF PRODUCTION (A+B)	2832.1	3039.9	3277.5	3542.5	3836.0	4160.3	4519.5	4914.9	5353.9	5811.6
D) SELLING EXPENSES	60.5	77.4	85.4	94.6	104.7	116.0	128.3	141.2	156.0	173.4
E) OPERATING INVENTORY	490.8	709.0	760.9	819.1	965.6	959.0	1040.1	1129.5	1229.7	1339.5
F) COSTING INVENTORY	708.0	760.0	819.4	935.6	959.0	1040.1	1129.6	1229.7	1338.5	1450.2
G) COST OF GOODS SOLD (C+E+F-D)	2684.4	3065.3	3303.5	3570.9	3867.4	4195.2	4557.3	4957.7	5401.0	5892.6

## PROJECTED BALANCE SHEET (1982-1992)

SCENARIO # 4

(US \$ MIL.)

	82-83	83-84	84-85	85-86	86-87	87-88	88-89	89-90	90-91	91-92
FIXED ASSETS (R1)	271.1	247.5	223.0	197.5	171.0	143.4	114.0	85.1	54.0	23.3
GROSS RECEIVABLES	850.6	870.6	890.6	910.6	930.6	950.6	970.6	990.6	1010.6	1030.6
LESS: DEDUCTION	579.5	623.0	667.5	713.1	759.6	807.1	855.6	905.2	955.7	1007.2
CURRENT ASSETS	1972.1	2150.9	2354.3	2583.2	2837.3	3119.6	3430.0	3774.9	4157.3	4581.9
INVENTORIES	1423.9	1544.9	1684.5	1841.4	2016.0	2209.9	2424.9	2663.9	2929.3	3224.9
OTHER CURRENT ASSETS	548.3	605.1	669.8	741.8	821.3	909.8	1005.1	1111.1	1229.0	1386.9
INVESTMENTS	146.7	146.7	146.7	146.7	146.7	146.7	146.7	146.7	146.7	146.7
TOTAL ASSETS	2389.9	2544.2	2724.1	2927.4	3154.9	3408.8	3691.6	4007.0	4359.9	4761.9
TOTAL LIABILITIES	4496.0	5362.7	6197.7	6994.5	7748.9	8457.6	9117.6	9726.3	10281.5	10567.9
LONG TERM LIABILITIES	1308.0	1308.0	1308.0	1308.0	1308.0	1308.0	1308.0	1308.0	1308.0	1308.0
CURRENT LIABILITIES	3188.0	4054.7	4889.7	5686.5	6440.9	7149.6	7809.6	8412.3	8973.5	9259.9
OWNERS EQUITY	-2106.1	-2818.5	-3473.6	-4057.1	-4594.0	-5048.9	-5426.0	-5719.3	-6022.6	-6316.0

## PROJECTED FINANCIAL RATIOS (1982-1992)

SCENARIO # 4

	82-83	83-84	84-85	85-86	86-87	87-88	88-89	89-90	90-91	91-92
CURRENT RATIO	0.62	0.53	0.48	0.45	0.44	0.44	0.44	0.45	0.46	0.49
GROSS PROFIT RATIO	-0.02	-0.06	-0.03	-0.00	0.02	0.04	0.06	0.07	0.09	0.10
OPERATING PROFIT RATIO	-0.23	-0.25	-0.21	-0.17	-0.14	-0.11	-0.08	-0.06	-0.04	-0.03
RETURN ON ASSETS	-0.25	-0.28	-0.24	-0.20	-0.17	-0.13	-0.10	-0.07	-0.05	-0.02
TOTAL INVENTORY TO SALES RATIO	0.54	0.53	0.52	0.52	0.51	0.51	0.50	0.50	0.50	0.50
FINISH INV. TO SALES RATIO	0.23	0.25	0.25	0.24	0.23	0.23	0.22	0.22	0.22	0.21

## DIGITAL FORECASTING FOR IRVING MARKET AND COMPANY (1932-1942)

本章主要介绍了如何使用 Python 的 `argparse` 模块来处理命令行参数，从而使得程序更加健壮和易用。

	82-83	83-84	84-85	85-86	86-87	87-88	88-89	89-90	90-91	91-92
TOTAL MARKET SHRES OF COMPANY (RS. CRDERS)	167.2	145.6	225.1	265.7	247.3	270.0	293.7	319.5	324.4	371.3
TOTAL MARKET SHRES OF COMPANIES (Wooltex & JPS LTD)	12816.9	13454.0	13089.1	11726.1	15359.2	15094.2	16529.3	17264.4	17679.2	19534.5
TOTAL MARKET KNITTING YARN (RS.)	767.3	771.5	235.8	300.1	264.3	1028.5	1092.8	1157.0	1221.3	1265.5
COMPANY'S KNITTING YARN (RS.)	46.9	44.4	42.1	40.0	38.1	36.4	34.8	33.3	32.0	30.8
PRICE OF KNITTING YARN (RS./KG.)	183.6	183.6	183.6	183.6	183.6	183.6	183.6	183.6	183.6	183.6
COMPANY'S RUGS & BLANKETS (RS.)	719.6	814.8	869.9	994.6	1260.7	1523.8	1622.6	2106.3	2163.3	4001.0
PRICE OF RUGS & BLANKETS (RS./PC)	104.3	112.7	121.7	131.4	141.9	153.3	165.6	178.8	193.1	208.5
COMPANY'S SHIRTINGS (RS.)	1922.8	2018.1	2113.4	2503.1	2611.1	2719.0	3325.9	3452.9	3579.9	3706.9
PRICE OF SHIRTINGS (RS./MTR.)	67.5	94.5	102.0	110.2	119.0	128.5	138.8	149.0	161.9	174.9

PREDICTED PRODUCTION PLANNING FOR COMPANY (1982-1992) SCENARIO : 5

本章主要讨论了如何通过分析和设计，将一个复杂的系统分解为多个子系统，从而实现系统的模块化设计。

	82-83	83-84	84-85	85-86	86-87	87-88	88-89	89-90	90-91	91-92
A) TOTAL VARTABUS COSTS	1645.1	1802.3	2008.5	2406.2	2865.7	3351.3	4194.2	5247.9	6138.1	7842.0
B) OTHER EXPENSES	1187.0	1217.3	1217.5	1277.8	1308.1	1338.4	1358.6	1398.9	1129.2	1159.4
T) COST OF PRODUCTION (A+B)	2832.1	3020.1	3256.1	3684.0	4173.8	4669.6	5552.9	5646.8	1867.3	9351.4
T1) SELLING EXPENSES	60.5	77.4	67.2	100.1	929.5	271.3	354.1	443.8	550.3	661.6
C) OPERATING EXPENSES	499.8	708.0	755.0	811.0	941.0	1043.4	1172.4	1390.7	1561.7	1906.8
D) CASTING TAXES	768.0	755.0	814.0	921.0	1043.4	1172.4	1390.7	1661.7	1966.8	2337.9
COST OF GOALS SOLD (T+T1+C+D)	2684.4	3050.5	3284.2	3675.5	4175.5	4709.7	5521.4	5606.7	1861.6	9339.3

## PROJECTED INCOME STATEMENTS (1982-1992)

SCENARIO # 5

(in \$,000's)

	82-83	83-84	84-85	85-86	86-87	87-88	88-89	89-90	90-91	91-92
SALES REVENUE	2560.6	2905.2	3316.5	4759.9	5712.0	6782.3	8853.0	11094.8	13758.2	17115.5
OTHER TAXES	51.6	58.1	66.3	82.8	99.3	118.0	134.0	193.0	239.3	297.7
TOTAL SALES REVENUE	2632.2	2963.3	3382.9	4842.5	5811.4	6900.2	9007.0	11287.7	13997.5	17413.2
LESS: COST OF 60125,000	2684.4	3050.5	3281.2	3676.5	4175.5	4700.7	5521.4	6606.7	7851.6	9339.3
GROSS PROFIT	-52.2	-66.1	-98.6	-1155.1	-1635.8	-2190.5	-3435.6	-1681.0	-6145.9	-8073.9
INTEREST	195.0	574.5	664.8	759.6	953.9	959.3	1029.5	1097.3	1180.0	1592.3
OPERATING PROFIT	-589.7	-716.7	-635.7	324.5	685.4	1111.2	2345.1	3471.6	4862.9	7267.5
PROVISION FOR TAXES	0.0	0.0	0.0	162.2	342.7	555.6	1172.5	1735.8	2426.4	3633.3
NET PROFIT	-589.7	-716.7	-635.7	162.2	342.7	555.6	1172.5	1735.8	2426.4	3633.3
DIVIDENDS AT 2.07	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	35.9	203.2
REPAIRED EARNINGS	-589.7	-716.7	-635.7	162.2	342.7	555.6	1172.5	1735.8	2390.6	3430.6

## PROJECTED BALANCE SHEET (1982-1992)

SCENARIO : 5

(US DOLLARS)

	82-83	83-84	84-85	85-86	86-87	87-88	88-89	89-90	90-91	91-92
FIXED ASSETS(121)	211.1	485.1	685.5	872.5	1046.0	1205.0	1314.0	1062.9	929.0	835.8
GROSS ASSETS	950.6	1120.6	1390.6	1550.6	1730.6	2220.6	2230.6	2200.6	2260.6	2260.6
LESS:DEPRECIATION	579.5	635.5	705.0	783.1	864.6	934.6	1015.6	1217.7	1330.7	1444.7
CURRENT ASSETS	1972.1	2149.9	2375.8	2941.1	3440.6	3981.6	4958.4	5103.4	7423.2	9055.2
INVENTORIES	1423.9	1532.5	1671.2	1929.8	2227.1	2540.7	3017.6	3746.2	4500.2	5419.0
OTHER CURRENT ASSETS	548.3	617.4	704.6	1011.3	1213.5	1440.9	1860.9	2357.1	2923.0	3636.3
INVESTMENTS	146.7	146.7	146.7	146.7	146.7	146.7	146.7	146.7	146.7	146.7
TOTAL ASSETS	2380.9	2761.7	3208.0	3750.3	4633.3	5334.2	6220.0	7272.9	8499.7	10037.7
TOTAL LIABILITIES	4194.9	5603.3	6605.4	7255.1	7585.7	7731.1	7444.3	6761.4	5597.6	3704.9
LONG TERM LIABILITIES	1308.0	1558.0	1808.0	2028.6	2308.0	2558.0	2558.0	2558.0	2558.0	2558.0
CURRENT LIABILITIES	3166.9	4045.3	4857.4	5697.1	5277.7	5173.1	4886.3	4203.4	3039.6	1146.9
OWNERS EQUITY	-2105.0	-2821.6	-3457.4	-3295.1	-2952.4	-2396.8	-1224.3	-511.5	2902.2	6332.8

## PROJECTED FINANCIAL RATIOS (1982-1992)

SCENARIO : 5

	82-83	83-84	84-85	85-86	86-87	87-88	88-89	89-90	90-91	91-92
CURRENT RATIO	0.62	0.53	0.49	0.57	0.65	0.77	1.01	1.45	2.44	7.90
GROSS PROFIT RATIO	-0.02	-0.03	0.03	0.24	0.29	0.32	0.39	0.42	0.45	0.47
OPERATING PROFIT RATIO	-0.23	-0.25	-0.19	0.07	0.12	0.16	0.26	0.31	0.35	0.42
RETURN ON ASSETS	-0.25	-0.26	-0.20	0.04	0.07	0.10	0.19	0.24	0.29	0.36
TOTAL INVENTORY TO SALES RATIO	0.54	0.52	0.49	0.40	0.38	0.37	0.34	0.33	0.32	0.31
FINISH INV. TO SALES RATIO	0.23	0.25	0.23	0.18	0.17	0.16	0.14	0.14	0.13	0.12